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# KEY

TO

# ADAMS'S NEW ARITHMETIC,

FOR THE USE OF TEACHERS.

BY THE AUTHOR.

KEENE, N. H.:
J. AND J. W. PRENTISS.
NEW YORK:
DAYTON AND SAXTON.
1842.

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# KEY

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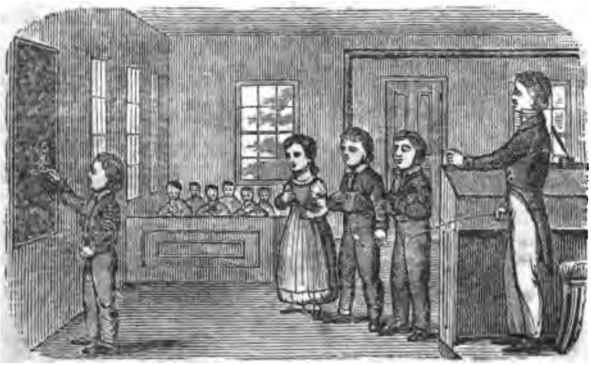

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# K E Y.

## ADDITION

### OF SIMPLE NUMBERS.

**¶ 5. EXAMPLES FOR PRACTICE.**

19. 1817
1950
2156
2210
*Ans.* 8133

20. 100
2160
785
92
*Ans.* 3137

21. 1200
850
1000
1086
74
*Ans.* 4210

22. 800,000
80,000
40,000
152,840
389,000
13,000
*Ans.* 1,474,840

23. 298,335
244,161
235,764
253,287
83,059
275,248
*Ans.* 1,389,854

24. 2513
307
180
251
244
363
102
44
*Ans.* 4004

25. 5,977,388,027,299, *Ans.*
26. 26,556,646,143,441, *Ans.*
27. 25,000,717,835,675, *Ans.*
28. 31,581,149,281,433, *Ans.*

29. 46723
6742
986
*Ans.* 54451

30. 140
64
234
73
47
36
25
*Ans.* 619

## SUPPLEMENT TO ADDITION.

### EXERCISES.

1. 1732
67
*Ans.* 1799

2. 481
1827
*Ans.* 2308

3. 8671
597
*Ans.* 9268

4. 684
876
*Ans.* 1560

5. 317
812
1350
2479
2479
*Ans.* 4958

6. 16000
1616
17616, daughter.
1800
19416, son.
17616, daughter.
*Ans.* 37032, estate

7. 1476
4768
4768
4768
4768
*Ans.* 20548

8. 375
375
375
375
*Ans.* 1500

9. 108
108
124
124
76
60
*Ans.* 600

10. 34
15
*Ans.* 49

11. 16
16
12
8
*Ans.* 52

---

## SUBTRACTION

## OF SIMPLE NUMBERS.

### ¶ 8. EXAMPLES FOR PRACTICE.

27. 10000 — 4567 = 5433 dollars, value of the land, *Ans.*
28. 1,659,854 — 1,232,454 = 427,400, incr. in 20 yrs., *Ans.*
29. 7,648,203 — 928,671 = 6,719,532, difference, *Ans.*
30. 1,487,945 — 358,642 = 1,129,303, must be added, *Ans.*
31. 15,293 — 13,682 = 1,611 dollars gained, *Ans.*

**32.** From 364,710,825,193
Take 27,940,386,574
*Rem.* 336,770,438,619

**33.** From 831,025,403,270
Take 651,308,604,782
*Rem.* 179,716,798,488

34. From 127,368,047,216,843
Take 978,654,827,352
*Rem.* 126,389,392,389,491

---

## SUPPLEMENT TO SUBTRACTION.

### EXERCISES.

1. $1775 - 1492 = 283$ years, *Ans.*
2. $1827 - 1773 = 54$ years, *Ans.*
3. $1826 - 80 = 1746$, *Ans.*
4. $15687 - 8764 = 6923$, the less number, *Ans.*
5. $3794 - 865 = 2929$, *Ans.*
6. $6350 - 789 = 5561$, *Ans.*
7. $123,706 - 43,940 = 79,766$, *Ans.*
8. $2,500 + 2,500 = 5,000$; then, $12,000 - 5,000 = 7,000$ dollars, the son's share, *Ans.*
9. $17,000,000 - 56,000 = 16,944,000$ will remain, *Ans.*
10. $1301 + 2561 + 3120 = 6982$; then, $10000 - 6982 = 3018$, *Ans.*
11. $187 - 114 = 73$ dollars more, *Ans.*
12. $10 + 10 + 10 + 10 + 10 + 10 + 10 + 1 + 1 + 1 = 73$; and $10 + 10 + 10 + 10 + 1 + 1 + 1 + 1 + 1 = 45$; then, $73 - 45 = 28 = 2$ ten dollar bills, and 8 one dollar, *Ans.*
13. $24 - 16 = 8$, difference, *Ans.*
14. $24 - 8 = 16$, the less number, *Ans.*
15. $40 - 16 = 24$, the greater number, *Ans.*
16. $68 - 49 = 19$ feet, height of the stump left, *Ans.*
18. $45 + 38 + 29 = 112$; and $17 + 10 + 5 = 32$; then, $112 - 32 = 80$ dollars, *Ans.*
19. $28 + 14 = 42$, and $42 - 40 = 2$ cents lost by the bargain, *Ans.*
20. $67 + 67 + 67 + 67 = 268$; and $42 + 42 + 42 + 42 = 168$; then, $268 - 168 = 100$ miles apart, close of the fourth day, *Ans.*
21. $40 + 40 = 80$, and $80 - 70 = 10$ miles apart Tuesday night, *Ans.*

22. 47 + 84 + 23 + 143 = 297, and 379 — 297 = 82 dollars still due, *Ans.*

23. 34764 — 14297 = 20467 dollars, *Ans.*

24. 274 — 194 = 80 dollars, what the second man paid; and 80 — 20 = 60 dollars, what the third man paid; then, 274 + 80 + 60 = 414, and 482 — 414 = 68 dollars, what the fourth man paid, *Ans.*

---

# MULTIPLICATION

## OF SIMPLE NUMBERS.

### ¶ 10. EXAMPLES FOR PRACTICE.

| | | |
|---|---|---|
| 18. 57<br>320<br>114<br>171<br>*Ans.* 18240 | 19. 436<br>320<br>872<br>1308<br>*Ans.* 139520 | 20. 784<br>69<br>7056<br>4704<br>*Ans.* 54096 |
| 21. 1851<br>758<br>14808<br>9255<br>12957<br>*Ans.* 1403058 dols. | 22. 24<br>7<br>168<br>365<br>840<br>1008<br>504<br>*Ans.* 61320 miles in 1 year. | 23. 13<br>28<br>104<br>26<br>364 No. yds.<br>6<br>*Ans.* 2184 dollars, whole cost. |
| 24. 37864<br>235<br>189320<br>113592<br>75728<br>*Ans.* 8898040 | 25. 29831<br>952<br>59662<br>149155<br>268479<br>*Ans.* 28399112 | 26. 93956<br>8704<br>375824<br>6576920<br>751648<br>*Ans.* 817793024 |

### ¶ 11. *When the multiplier is a composite number.*

3. 8 × 7 × 2 = 112;
hence, 342
8
2736
7
19152
2
*Ans.* 38304

4. 6 × 8 = 48;
hence, 367
6
2202
8
*Ans.* 17616

5. 7 × 8 = 56;
hence, 853
7
5971
8
*Ans.* 47768

6. 6 × 12 = 72;
hence, 1086
6
6516
12
*Ans.* 78192

### ¶ 12. *When the multiplier is* 10, 100, 1000, *&c.*

1. 76 × 10 = (*annex one cipher*) 760 dollars, *Ans.*
2. 126 × 100 = (*annex two ciphers*) 12600 dollars, *Ans.*
3. 312 × 1000 = (*annex three ciphers*) 312000 dollars, *Ans.*
4. 5682 × 10000 = (*annex four ciphers*) 56820000, *Product.*
5. 82134 × 100000 = (*annex five ciphers*) 8213400000, *Prod.*

### ¶ 13. *When there are ciphers on the right hand of the multiplicand, &c.*

2. 400
700
*Ans.* 280000

3. 357
6300
1071
2142
*Ans.* 2249100

4. 8600
17
602
86
*Ans.* 146200

5. 9340
460
5604
3736
4296400

6. 5200
410
52
208
2132000

*When there are ciphers between the significant figures, &c.*

$$\begin{array}{rr}
9. & 543 \\
 & 206 \\
\hline
 & 3258 \\
 & 1086\phantom{00} \\
\hline
\textit{Ans.} & 111858
\end{array}
\qquad
\begin{array}{rr}
10. & 1620 \\
 & 2103 \\
\hline
 & 486 \\
 & 162\phantom{0} \\
 & 324\phantom{000} \\
\hline
\textit{Ans.} & 3406860
\end{array}
\qquad
\begin{array}{rr}
11. & 36243 \\
 & 32004 \\
\hline
 & 144972 \\
 & 72486\phantom{00} \\
 & 108729\phantom{0000} \\
\hline
\textit{Ans.} & 1159920972
\end{array}$$

---

## SUPPLEMENT TO MULTIPLICATION.

1. 10700 × 46 = 492200 dollars taken, *Ans.*

2. 145 × 2 = 290 (families,) which × 6 = 1740 inhabitants, *Ans.*

3. 46 × 60 = 2760 days' work, or men required, *Ans.*

4. 27 × 6 = 162, and 31 × 6 = 186; then, 162 + 186 = 348 miles apart, *Ans.*

5. 4 × 7 × 6 × 20 = 3360, *Ans.*

6. 18 × 90 = 1620 days, *Ans.*

7. 115 × 27 = 3105 dollars, *Ans.*

8. 265 × 98 = 23585, *Ans.*

9. 9 × 12 × 14 = 1512, *Ans.*

10. 346 × 95 = 32870 times, *Ans.*

11. 60 × 40 = 2400 seconds in 40 minutes, *Ans.*

12. 60 × 60 = 3600 seconds in an hour, and 3600 × 3 (the hours from 9 o'clock to 12) = 10800 seconds, *Ans.*

13. 467 × 6 = 2802 shillings, *Ans.*

14. 52 — 44 = 8, which × 10 = 80 miles, *Ans.*

15. 84 × 6 = 504 cents for 84 years, *Ans.*

16. 95 × 6 = 570 cents, *Ans.*

17. 468 × 6 = 2808 cents, and 48 × 7 = 336 cents; then, 2808 + 336 = 3144 cents, *Ans.*

18. 10 — 7 = 3, and 3 × 5 = 15 cents, *Ans.*

19. 4 × 5 × 7 × 6 × 9 × 8 × 3 = 181440, *Ans.*

20. 63 × 8 = 504 gallons in 8 hogsheads, and 504 gallons × 4 = 2016 quarts, which × 2 = 4032 pints, *Ans.*

# DIVISION

## OF SIMPLE NUMBERS.

### ¶ 19. EXAMPLES FOR PRACTICE.

1. 27 ) 6318 ( 234.
54
91
81
108
108

2. 52 ) 1248 ( 24.
104
208
208

3. 29 ) 153598 ( $5296\frac{14}{29}$.
145
85
58
279
261
188
174
14

4. 63 ) 30131 ( $478\frac{17}{63}$.
252
493
441
521
504
17

5. 92 ) 7652 ( $83\frac{16}{92}$.
736
292
276
16

6. 256 ) 7168 ( 28 dol.
512
2048
2048

7. 365 ) 974932 ( $2671\frac{17}{365}$.
730
2449
2190
2593
2555
382
365
17

8. 563 ) 3228242 ( 5734 dol.
2815
4132
3941
1914
1689
2252
2252

9. 976 ) 57624 ( 59$\frac{40}{976}$.
4880
8824
8784
40

10. 3215 ) 1030603615 ( 320561.
9645
6610
6430
18036
16075
19611
19290
3215
3215

11. 8766 ) 596088000 ( 68000.
52596
70128
70128

12. 1307 ) 1234567890 ( 944581$\frac{523}{1307}$.
11763
5826
5228
5987
5228
7598
6535
10639
10456
1830
1307
523

13. 7812 ) 40703020 ( 5210$\frac{2500}{7812}$.
39060
16430
15624
8062
7812
2500

14. 9124 ) 987649031 ( 108247$\frac{3403}{9124}$.
9124
75249
72992
22570
18248
43223
36496
67271
63868
3403

### ¶ **20.** *When the* DIVISOR *is a* COMPOSITE NUMBER.

3. $\frac{576}{48}$. $6\times 8=48$; therefore, $576\div 6=96$, and $96\div 8=12$, *Ans.*
4. $\frac{1260}{63}$. $7\times 9=63$, then $1260\div 7=180$, and $180\div 9=20$, *Ans.*
5. $\frac{2430}{81}$. $9\times 9=81$; $2430\div 9=270$, which $\div\, 9=30$, *Ans.*
6. $\frac{448}{56}$. $7\times 8=56$; $448\div 7=64$, which $\div\, 8=8$, *Ans.*

### ¶ **21.** *To divide by* 10, 100, 1000, *&c.*

3. $1|00\,)\,345|67=345\frac{67}{100}$, that is, 345 dollars 67 cents, *Ans.*
4. $1|00\,)\,45678|40=45678\frac{40}{100}$, that is, 45678 dollars 40 cents, *Ans.*
5. $1|00\,)\,3456|00=3456$ dollars, *Ans.*
6. $1|00\,)\,426|04=426\frac{04}{100}=426$ dollars 4 cents, *Ans.*
7. $1|000\,)\,845|000=845$ dollars, *Ans.*
8. $1|000\,)\,6|487=6\frac{487}{1000}=6$ dollars 487 mills, *Ans.*
9. $1|000\,)\,96842|378=96842\frac{378}{1000}=96842$ dollars 378 mills, *Ans.*
10. $1|0\,)\,3464|0=3464$ cents, *Ans.*

### ¶ **22.** *When there are* CIPHERS *on the right hand of the divisor.*

4. 2|0 ) 34650|0

17325 yards, *Ans.*

5. 9|00000 ) 764|28400

$84\frac{828400}{900000}$, *Quotient.* In dividing 764 by 9, there is a remainder of 8, to which annexing, or bringing down, the figures cut off in the dividend, makes the fraction $\frac{828400}{900000}$.

6. 84|000 ) 345006|000 ( $4107\frac{18}{84}$, *Quotient.*
336
90
84
606
588
18000, *Remainder.*

7. 7|0000 ) 468|0000

$66\frac{6}{7}$, *Quotient.*

## SUPPLEMENT TO DIVISION.

### EXERCISES.

1. 15|00 ) 26250|00; then, 26250 ÷ 15 = 1750 dollars, *Ans.*
2. 18950 ÷ 25 = 758 men, *Ans.*
3. 7412 ÷ 34 = 218 in a cask, *Ans.*
4. 505710 ÷ 135 = 3746, *Ans.*
5. 95,000,000 ÷ 8 = 11,875,000 miles a minute, *Ans.*
6. 704 ÷ 11 = 64, *Ans.*
7. 704 ÷ 64 = 11, *Ans.*
8. 144 ÷ 18 = 8, *Ans.*
9. 144 ÷ 8 = 18, *Ans.*
10. 585 ÷ 13 = 45 miles each day, *Ans.*
11. 585 ÷ 45 = 13 days, *Ans.*
12. 560 ÷ 35 = 16 dollars, *Ans.*
13. 560 ÷ 16 = 35 cows, *Ans.*
14. 364812 ÷ 12 = 30401 feet, *Ans.*
15. 364812 ÷ 30401 = 12 inches, *Ans.*
16. 4875|0 ÷ 5|0 = 975 dollars, *Ans.*
17. 48750 ÷ 975 = 50 men, *Ans.*
18. 17484 ÷ 186 = 94 pounds, *Ans.*
19. 17484 ÷ 94 = 186 chests, *Ans.*
20. 1740 ÷ 12 = 145 houses, and 12 (the number of persons in each house) ÷ 2 (the number of families) = 6, the number of persons in each family, *Ans.*
21. 2760 ÷ 120 = 23 men to dig it in 120 days, *Ans.*
22. 32870 ÷ 95 = 346 times in running 1 mile, *Ans.*
23. 2419200 ÷ 60 = 40320 minutes, *Ans.*
24. 525960 ÷ 60 = 8766 hours, *Ans.*
25. 8766 ÷ 24 = $365\frac{6}{24}$ = 365 days, 6 hours, *Ans.*
26. 480 ÷ 48 = 10 times, *Ans.*
27. 47854 ÷ 3478 = $13\frac{2640}{3478}$, = 13 times and a remainder of 2640, *Ans.*
28. 32 ÷ 8 = 4 quarts, *Ans.*
29. 204030648 ÷ 2 = 102015324, *Ans.*
30. 3456320 ÷ 3 = $1152106\frac{2}{3}$, *Ans.*

---

## MISCELLANEOUS QUESTIONS.

1. 218 + 142 = 360 dollars, *Ans.*
2. 360 − 218 = 142 dollars, cost of the horse; and 360 − 142 = 218 dollars, cost of the chaise, *Ans.*

3. 487 — 348 = 139, the less number; and 487 — 139 = 348, the greater number, *Ans.*

4. 7842 — 3481 = 4361, the remainder; and 7842 — 4361 = 3481, the subtrahend, *Ans.*

¶ **23.** 5. 48 — 19 = 29, *Ans.*

6. 29 — 10 = 19, the less number, *Ans.*

7. 19 + 10 = 29, the greater number,

8. 44 × 5 = 220; 974 × 3 = 2922; 600 × 6 = 3600; and 220 + 2922 + 3600 = 6742 dollars, *Ans.*

9. 15 × 6 = 90, and 90 + 67 = 157; then, 157 — 124 = 33 dollars, *Ans.*

10. 15 × 13 = 195 cents, *Ans.*

11. 487 ÷ 2 = $243\frac{1}{2}$ bushels, *Ans.*

¶ **24.** 12. 948 × 84 = 79632 cents = 796 dollars 32 cents, *Ans.*

13. 28400 ÷ 648 = $43\frac{536}{648}$ cents per pound, *Ans.*

14. 754 × 25 = 18850, *Ans.*

15. 18850 ÷ 25 = 754, *Ans.*

16. 18850 ÷ 754 = 25, *Ans.*

17. 365 × 6 = 2190 cents saved in 1 year, and 2190 × 45 = 98550 cents saved in 45 years; 12 dollars = 1200 cents, the cost of 1 cow; then, 98550 ÷ 1200 = $82\frac{150}{1200}$, that is, 82 cows and $\frac{150}{1200}$ of another cow, *Ans.*

18. 8 × 4 = 32 × 2 = 64 — 34 = 30 + 10 = 40, *Ans.*

19. 64 × 3 = 192 ÷ 8 = 24 + 7 = 31 — 4 = 27, *Ans.*

20. 8 × 8 = 64 squares, *Ans.*

¶ **25.** 22. 40 × 24 = 960 square rods, *Ans.*

23. 12 × 12 = 144 square inches, *Ans.*

24. 14 × 2 = 28 square feet, *Ans.*

25. 6 × 6 = 36 square miles, *Ans.*

26. 12480 ÷ 20 = 624, and 624 × 2 = 1248 acres bought; then, 22464 ÷ 1248 = 18 dollars, the cost per acre, *Ans.*

27. 4 quarts × 12 cents = 48 cents, to which + 34 cents (had for the knife) = 82 cents; then, 86 — 82 = 4 cents lost by the bargain, *Ans.*

28. 5 × 6 = 30 seats, which × 2 = 60 pupils,
2 × 3 = 6 do. which × 2 = 12 do.
One long seat = - - - - - 8 do.
80 do. *Ans.*

29. 16 × 15 = 240, to which + 12 (feet waste) = 252 feet, *Ans.*

30. 6 × 5 = 30, and 30 — 3 = 27 yards, *Ans.*

31. 28 ÷ 14 = 2 feet, *Ans.*

32. 144 ÷ 6 = 24 pounds, *Ans.*

33. 25 (pounds of tea) × 42 = 1050, and 1050 ÷ 15 = 70 pounds of butter, *Ans.*

36. 30 ÷ 3 = 10, which is $\frac{1}{3}$ of 30; then, 10 × 2 = 20, which is $\frac{2}{3}$ of 30, *Ans.*

39. 246876 ÷ 4 = 61719, which is $\frac{1}{4}$ of 246876; and 61719 × 3 = 185157, which is $\frac{3}{4}$ of 246876, *Ans.*

41. 12243648 (inches) ÷ 12 (the inches in one foot) = 1020304 feet, *Ans.*

42. 128 ÷ 4 = 32 cents, cost of 1 pound; and 32 × 100 = 3200 cents, cost of 100 pounds, *Ans.*

43. 20 × 4 = 80 cents, which ÷ 4 = 20 oranges, *Ans.*

44. 68000 × 24 = 1632000 miles in 1 day; 1632000 × 365 = 595680000 miles in 1 year, which ÷ 40 = 14892000 ÷ 365 = 40800 years, *Ans.*

45. 80 × 6 (the working days in 1 week) = 480 cents per week, which × 20 = 9600 cents, *Ans.*

46. 23 + 14 = 37, age of the father when his wife died; 37 — 12 = 25, his age when his daughter was born; and 25 — 5 = 20, his age when his daughter's husband was born; then, 20 + 40 = 60 years old at his death, *Ans.*

47. 20 × 8 = 160 rods, *Ans.*

48. 160 ÷ 20 = 8 rods wide, *Ans.*

49. 160 ÷ 8 = 20 rods long, *Ans.*

50. 400 ÷ 25 = 16 rods wide, *Ans.*

---

## ADDITION AND SUBTRACTION OF FEDERAL MONEY.

### ¶ 28. EXAMPLES FOR PRACTICE.

1. \$ 6‘75 + \$ 2‘30 + \$ ‘92 + \$ ‘125 + \$ ‘06 = \$ 10‘15$\frac{1}{2}$, *Ans.*

2. \$ 237‘62 + \$ 350‘00 + \$ 86‘125 + \$ 9‘625 + \$ ‘834 = \$ 684‘204, *Ans.*

3. \$ 300‘00 + \$ 50‘60 + \$ 9‘08 = \$ 359‘68, *Ans.*

4. \$ 56‘18 + \$ 7‘375 + \$ 280‘00 + \$ ‘287 + \$ 17‘00 + \$ 90‘413 = \$ 451‘255, *Ans.*

5. \$ 76‘50 + \$ 85‘00 + \$ 17‘25 = \$ 178‘75, *Ans.*

6. \$ ‘28 + \$ ‘375 + \$ ‘24 + \$ 11‘00 + \$ 1‘625 + \$ ‘06 + \$ ‘04 = \$ 13‘62, *Ans.*

8. $ 21‘375 — $ 18‘00 = $ 3‘37½, *Ans.*
9. $ 82‘00 — $ 79‘75 = $ 2‘25, loss, *Ans.*
10. $ 176‘00 — $ 16‘50 = $ 159‘50, *Ans.*
11. $ 5400‘00 — $ 725‘375 = $ 4674‘62½, *Ans.*
12. $ 500‘00 — $ ‘83 = $ 499‘17, *Ans.*
13. $ 1200‘00 — $ 800‘35 = $ 399‘65, *Ans.*
14. $ 7‘00 — $ ‘005 = $ 6‘995, *Ans.*
15. $ 25‘00 — $ 16‘82 = $ 8‘18, *Ans.*
16. $ 250‘00 — $ 87‘14 = $ 162‘86, *Ans.*
17. $ 10‘00 — $ 6‘25 + $ ‘41 = $ 2‘34, *Ans.*

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## ¶ 29. MULTIPLICATION OF FEDERAL MONEY.

3. $ ‘885 × 250 = $ 221‘25, *Ans.*
4. $ 6‘375 × 87 = $ 554‘62½, *Ans.*
5. $ ‘285 × 63 = $ 17‘95½, *Ans.*
6. $ ‘125 × 365 = $ 45‘62½, which × 5 = 228‘12½, *Ans.*
7. $ 36‘75 × 17800 = $ 654150‘00, *Ans.*
8. $ 367‘00 × 46 = $ 16882‘00, *Ans.*
9. $ ‘273 × 8600 = $ 2347‘80, *Ans.*
12. $ 18745 ÷ 2 = $ 9372‘50, *Ans.*
13. $ 9366 ÷ 3 = $ 3122, *Ans.*
14. $ 48240 ÷ 16 = $ 3015, *Ans.*
15. $ 4870 ÷ 20 = $ 243‘50, *Ans.*
16. $ 151020 ÷ 5 = $ 30204, *Ans.*
17. 12½ cents = ⅛ of a dollar, and $ 264 ÷ 8 = $ 33, *Ans.*

19. $ 1‘12½ = 1 dollar and ⅛ of another dollar; one time $ 8460 and ⅛ of another time = $ 9517‘50, *Ans.* At $ 4‘06¼ = 4 dollars and 1/16 part of another dollar; $ 8460 × 4 = $ 33840; and $ 8460 ÷ 16 = $ 528‘75; then, $ 33840 + $ 528‘75 = $ 34368‘75, *Ans.*

## ¶ 30. *To find the value of articles sold by the* 100 *or* 1000.

3. 3460 × $ 4 = $ 138‘40, (removing the separatrix two places,) *Ans.*
4. 24650 × $ 5 = $ 123‘25 (.... three places,) *Ans.*
5. 4750 × $ 12‘25 = $ 58‘18¾ (.... three places,) *Ans.*
6. 38600 × $ 4‘75 = $ 183‘35 (.... three places,) *Ans.*
7. 46590 × $ 10‘625 = $ 495‘01 + (.... three places,) *Ans.*

8. 75 × $ 4 = $ 3 (.... two places,) *Ans.*
9. 4000 × $ 3 = $ 12 (.... three places,) *Ans.*

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## DIVISION OF FEDERAL MONEY.

### ¶ 31. EXAMPLES FOR PRACTICE.

5. $ 468‘75 ÷ 750 ($\frac{468‘75}{750}$) = $ 0‘625, *Ans.*
6. $ 181‘25 ÷ 125 ($\frac{181‘25}{125}$) = $ 1‘45, *Ans.*
7. $ 1913‘52 ÷ 536 ($\frac{1913‘52}{536}$) = $ 3‘57, *Ans.*
8. $ 3213 ÷ 84 ($\frac{3213}{84}$) = $ 38‘25, *Ans.*
9. $ 954 ÷ 3816 ($\frac{954}{3816}$) = $ 0‘25, *Ans.*
10. $ 8 ÷ 72 ($\frac{8}{72}$) = $ 0‘111 +, *Ans.*
11. $ 12 ÷ 200 ($\frac{12}{200}$) = $ 0‘06, *Ans.*
12. $ 30 ÷ 750 ($\frac{30}{750}$) = $ 0‘04, *Ans.*
13. $ 60 ÷ 1200 ($\frac{60}{1200}$) = $ 0‘05, *Ans.*
14. $ 215 ÷ 86 ($\frac{215}{86}$) = $ 2‘50, *Ans.*
15. $ 176 ÷ 250 ($\frac{176}{250}$) $ 0‘704, *Ans.*

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## SUPPLEMENT TO FEDERAL MONEY.

### EXERCISES.

1. 23 firkins × 42 lbs. = 966 lbs., which × 16½ cts. = $ 159‘39, whole cost; and $ 159‘39 ÷ 23 fir. = $ 6‘93, cost per firkin, *Ans.*

2. 129 + 129 = 258 lbs. × 5 cts. = $ 12‘90
123 + 125 = 248 " × 4½ " = 11‘16
Hide & tallow = 163 lbs. × 7 cts. = 11‘41
} = $35‘47, *Ans.*

3.

| | | |
|---|---|---|
| **Dr.** | 25 lbs. clover seed, at 11 cts. - - - - | $ 2‘75 |
| | 3 pecks herds grass seed, - - - - - | 2‘25 |
| | 1 barrel flour, - - - - - - - - - - - | 6‘50 |
| | 13 lbs. sugar, at 12½, - - - - - - - - | 1‘62½ |
| | | $ 13‘12½ |
| **Cr.** | 3 cheeses, 27 lbs. each, 81 lbs., at 8½ cts. - - - - - - | $ 6‘88½ |
| | 5 barrels cider, at $ 1‘25, - - - - - - - | 6‘25 |
| | Balance for the farmer, | $ 13‘13½ |

$\frac{1}{5}$) 1694
99
9906
775
one forth 25 8
775½
2-1-17
4 + 25 =

4. $ 71600 — $ 39876‘74 = $ 31723‘26, which ÷ 7 = $ 4531‘89 +, *Ans.*

5. 100 × 87 cts. = $ 87‘00, which ÷ 25 = 348 lbs., *Ans.*

6. 126 lbs. × 3 = 378 lbs., which ÷ 8 = $ 47‘25, *Ans.*

7. $ 86‘75 × 650 = $ 56387‘50, *Ans.*

8. 275 × 6¼ cts. = 1718¾ cts., which ÷ 50 = 34 18/50 bu., *Ans.*

9. $ 9‘32 × 18 = $167‘76, which ÷ $ 4‘66 = 36 yards, *Ans.*

10. $ 3‘75 × 16 = $ 60‘00 ; $ 4‘50 × 21 = $ 94‘50; $ 5‘12½ × 35 = $ 179‘37½ ; then, $ 60‘00 + $ 94‘50 + $ 179‘37½ = $ 333‘87½, *Ans.*

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# REDUCTION.

## ENGLISH MONEY.

### ¶ 34. EXAMPLES FOR PRACTICE.

3. 32 £. × 20 = 640 s. + 15 s. = 655 s. × 12 = 7860 d. + 8 d. = 7868 d. × 4 = 31472 qrs., *Ans.*

4. *Reverse the foregoing process;* thus, 31472 qrs. ÷ 4 = 7868 d., which ÷ 12 = 655 s. + 8 d., and 655 s. ÷ 20 = 32 £. + 15 s., together making 32 £. 15 s. 8 d., *Ans.* *So in the following examples.*

5. 29 guineas × 28 = 812 s. × 12 = 9744 d. × 4 = 38976 qrs., *Ans.*

7. $ 163 × 6 = 978 s. × 12 = 11736 d., *Ans.*

9. 15 guineas × 28 = 420 s. ÷ 20 = 21 £., *Ans.*

---

## TROY WEIGHT.

11. 3 lb. × 12 = 36 oz. + 5 oz. = 41 oz. × $ 1‘08 = $ 44‘28, *Ans.*

13. 210 lb. × 12 = 2520 oz. + 8 oz. = 2528 oz. × 20 = 50560 pwt. + 12 pwt. = 50572 pwt., *Ans.*

15. 7 lb. × 12 = 84 oz. + 11 = 95 oz. × 20 = 1900 pwt. + 3 pwt. = 1903 pwt. × 24 = 45672 grs. + 9 grs. = 45681 grs., *Ans.*

2= 5 2 + 17 = 201 + 3 − 807 + 5 = 40

## APOTHECARIES' WEIGHT.

17. 9 ℔ × 12 = 108 ℥ + 8 ℥ = 116 ℥ × 8 = 928 ʒ + 1 ʒ = 929 ʒ × 3 = 2787 ℈ + 2 ℈ = 2789 ℈ × 20 = 55780 grs. + 19 grs. = 55799 grs., *Ans.*

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## AVOIRDUPOIS WEIGHT.

19. 5 cwt. × 4 = 20 cwt. + 3 cwt. = 23 cwt. × 28 = 644 lbs. + 17 lbs. = 661 lbs. ÷ 8 (¶ 29, ex. 10, note) = $ 82,62½, *Ans.*

21. 109 cwt. × 4 = 436 cwt. × 28 = 12208 lbs. + 12 lbs. = 12220 ÷ 26 = 470 boxes, *Ans.*

23. 12 tons × 20 = 240 cwt. + 15 cwt. = 255 cwt. × 4 and + 1 qr. = 1021 qrs. × 28 and + 19 lbs. = 28607 lbs. × 16 and + 6 oz. = 457718 oz. × 16 and + 12 drs. = 7323500 drs., *Ans.*

25. 28 lbs. × 7000 = 196000 grs. Troy, which ÷ 24 = 8166 pwt. 16 grs., and 8166 pwt. ÷ 20 = 408 oz. 6 pwt.; then, 408 oz. ÷ 12 = 34 lbs.; whence, 34 lbs. 0 oz. 6 pwt. 16 grs., *Ans.*

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## CLOTH MEASURE.

27. 573 yds. × 4 = 2292 qrs. + 1 = 2293 qrs. × 4 and + 1 nail = 9173 nails, *Ans.*

29. 151 ells Eng. × 5 = 755 qrs., which ÷ 4 = 188¾ yds., *Ans.*

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## LONG MEASURE.

33. 482 miles × 320 = 154240 rods, × 16½ = 2544960 ft. × 12 = 30539520 in., *Ans.*

35. 40 miles × 320 = 12800 rods, × 16½ = 211200 ft. × 12 = 2534400 in.; 16 ft. 6 in. = 198 in.; then, 2534400 in. ÷ 198 in. = 12800 times, *Ans.*

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## ¶ 35. LAND OR SQUARE MEASURE.

37. 17 acres × 4 and + 3 = 71 roods, × 40 and + 12 = 2852 sq. rods, × 272¼ = 776457 sq. ft., *Ans.*

39. 64 sq. miles × 640 = 40960 acres, × 160 = 6553600 sq. rods, × 272¼ = 1,784,217,600 sq. ft., *Ans.*

41. 6 × 6 = 36 sq. miles, × 640 = 23040 acres, *Ans.*

## ¶ 36. SOLID OR CUBIC MEASURE.

43. 9 tons × 40 = 360 solid ft. × 1728 = 622080 cubic inches, *Ans.*

45. 37 cord ft. × 16 = 592 solid feet, *Ans.*

47. 64 cord ft. ÷ 8 = 8 cords, *Ans.*

49. 16 cords × 8 = 128 cord ft. × 16 = 2048 solid feet, *Ans.*

## WINE MEASURE.

51. 12 pipes × 2 = 24 hhds. × 63 = 1512 gal. × 4 = 6048 qts. × 2 = 12096 pts., *Ans.*

53. 9 pipes × 2 and + 1 = 19 hhds. × 63 and + 22 = 1219 gal. × 4 and + 3 = 4879 qts. × 2 = 9758 pts. × 4 = 39032 gills, *Ans.*

55. 1 T. × 4 = 4 hhds. × 63 = 252 gallons, *Ans.*

## ALE OR BEER MEASURE.

57. 47 bar. × 36 and + 18 = 1710 gal. × 4 = 6840 qts. × 2 = 13680 pints, *Ans.*

59. 29 hhds. × 54 = 1566 gal. × 4 = 6264 qts. × 2 = 12528 pints, *Ans.*

## DRY MEASURE.

61. 75 bu. × 4 = 300 pks. × 8 = 2400 qts. × 2 = 4800 pts., *Ans.*

63. 42 chal. × 36 = 1512 bu. × 4 = 6048 pks., *Ans.*

## ¶ 37. TIME.

65. 365 d. × 24 and + 6 = 8766 h. = 1 year, which × 15 = 131490 h. in 15 years, + 467 h. (= 19 d. 11 h.) = 131957 h. × 60 and + 37 m. = 7917457 m. × 60 and + 45 seconds = 475047465 seconds, *Ans.*

67. Jan. 31 + Feb. 28 + March 31, &c. = 226 days = 325440 minutes, *Ans*

69. From Apr. 19, 1775, to Apr. 19, 1782, is 7 years, = 61362 h.; and from Apr. 19, 1782, to Jan. 20, 1783, is 276 days, = 6624 h. + 61362 h. = 67986 h. × 60 = 4079160 m., *Ans.*

1783 – 1 – 20
1775 – 4 – 19
7

365 + 7 = 2555 + 276 = 2831 ×
24 = 67986 + 60 = 4079160

## CIRCULAR MEASURE, OR MOTION.

71. 9 signs × 30 and + 13° = 283° × 60 and + 25′ = 17005′ × 60 = 1020300″, *Ans.*

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## SUPPLEMENT TO REDUCTION.

### EXERCISES.

1. 46 £ . 4 s. = 924 s. ÷ 6 = $ 154, *Ans.*

2. 36 g. × 28 = 1008 s. = 12096 d.; 6 s. 7 d. = 79 d.; then, 12096 d. ÷ 79 d. = 153 crowns and 9 d., *Ans.*

3. 3 lb. 5 oz. 16 pwt. 2 grs. = 20066 grs.; 5 pwt. 7 grs. = 127 grs.; then, 20066 grs. ÷ 127 grs. = 158 rings, *Ans.*

4. 212 rods = 41976 in.; and 18 ft. 6 in. = 222 in.; then, 41976 in. ÷ 222 in. = $189\frac{18}{222}$ times, *Ans.*

5. 470 boxes × 26 = 12220 lb. ÷ 112 lb. (= 1 cwt.) = $109\frac{12}{112}$ cwt., *Ans.*

6. 10 lb. = 2400 pwt.; 5 oz. 10 pwt. = 110 pwt.; then, 2400 pwt. ÷ 110 pwt. = $21\frac{90}{110}$ spoons, *Ans.*

7. 4 in. × 6 in. = 24 sq. in. covered by 1 shingle, and 144 sq. in. (= 1 sq. ft.) ÷ 24 = 6 shingles to cover 1 sq. ft.; 40 ft. × 24 ft. = 960 sq. ft. (the area of the roof) × 6 = 5760 shingles, *Ans.*

8. 26 ft. × 4 ft. × 6 ft. = 624 solid ft. ÷ 16 = 39 cord ft. ÷ 8 = 4 cords, 7 cord ft., *Ans.*

9. 18 + 18 + 16 + 16 = 68 ft. (circuit round the room) × 8 = 544 sq. ft. (to be covered;) 11 yds. = 33 ft. × 2 = 66 sq. ft.; then, 544 sq. ft. ÷ 66 sq. ft. = $8\frac{16}{66}$ rolls, *Ans.*

10. $6\frac{1}{2} \times 2 \times 5 = 65$ solid ft. ÷ $\frac{1}{16}$ — $4\frac{1}{16}$ cord ft., *Ans.*

11. 3 w. 4 d. 16 h. = 616 hours × 7 = 4312 miles, *Ans.*

12. 1 hhd. = 63 gal. × $ 2‘75 = $ 173‘25, cost of 1 hhd.; $ 173‘25 × 12 = $ 2079, cost of 12 hhds., *Ans.*

13. 29 £ . 1 s. = 581 s. ÷ 7 = 83 yds., *Ans.*

14. 10 £ . 8 s. = 2496 d.; 5 s. 4 d. = 64 d.; then, 2496 d. ÷ 64 d. = 39 oz., *Ans.*

15. 2 lb. 8 oz. 16 pwt. = 656 pwt. × 3 d. = 1968 d. = 8 £ . 4 s., *Ans.*

16. 1 T. 2 cwt. 3 qrs. 16 lb. = 2564 lb. × $ 0‘18 = $ 461‘52, *Ans.*

17. 14445 ells Fl. × 3 = 43335 qrs. ÷ 5 = 8667 ells E., *Ans.*

18. 44½ × 3 = 133½ shingles to lay one course; 20 ft. × 3 = 60 courses on one side, × 133½ = 8010 shingles to cover one side, × 2 = 16020 shingles to cover both sides, *Ans.*

19. 320 r. (= 1 mile) × 54½ = 17440 r. × 16½ = 287760 ft. × 12 = 3453120 in. ÷ 30 = 115104 steps, *Ans.*

20. 365 d. × 40 = 14600 days × 30 = 438000 m. × 60 = 26280000 s., *Ans.*

21. 365 — 52 = 313 (working days in 1 year) × 45 = 14085 d. × 4 = 56340 s. ÷ 6 = $9390, *Ans.*

22. (*If* 9 *candles from* 1 *lb., how many doz. from* 24 *lb.?*) 24 × 9 = 216 (candles) ÷ 12 = 18 doz., *Ans.*

23. Note. *This example was improperly introduced at this place, and is withdrawn from the Arithmetic.*

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# ADDITION

## OF COMPOUND NUMBERS.

### ¶ 38. EXAMPLES FOR PRACTICE.

English Money. *Amounts,* 601 £. 18 s. 2 d. 3 qr.; 127 £. 6 s. 10½ d.; 193 £. 12 s. 6 d.

Troy Weight. *Amounts,* 160 lb. 9 oz. 16 pwt. 15 grs.; 18 oz. 12 pwt. 11 grs.; 4 oz. 1 pwt. 14 grs.; 2 lb. 6 oz. 12 pwt. 13 grs.

Avoirdupois Weight. *Amounts,* 47 T. 10 cwt. 0 qr. 25 lb. 11 oz. 2 dr.; 17 cwt. 3 qr. 1 lb. 11 oz. 4 dr.; 5 T. 0 cwt. 0 qr. 2 lb.

Cloth Measure. *Amounts,* 143 yds. 3 qr. 2 na.; 117 E. Fl. 1 qr. 2 na.; 135 E. E. 3 qr. 3 na.; 114 yds.

Long Measure. *Amounts,* 955 deg. 20 m. (*geog.*) 0 fur. 11 r. 7 ft. 1 in. 1 bar.; 12 m. 5 fur. 27 pol.

Land Measure. *Amounts,* 67 pol. 225 ft. 43 in.; 503 A. 0 roods, 16 pol. 168 ft. 84 in.; 58 A. 1 rood, 19 poles.

Note. *In the two first of the three foregoing examples, the hundreds, in the denomination of feet, in the Arithmetic, were stricken off,* (1842,) *so as to bring out the above results.*

Solid or Cubic Measure. *Amounts,* 50 T. 27 ft. (round,) 482 in.; 89 yds. 14 ft. 970 in.; 96 cords, 100 ft.

Wine Measure. *Amounts,* 88 hhd. 43 gal. 1 qt.; 85 T. 2 hhd. 33 gal. 3 qts.; 2 hhd. 12 gal.

Dry Measure. *Amounts,* 56 bu. 2 pk. 4 qts. 1 pt.; 55 ch. 21 bu. 1 pk. 4 qts.

Time. *Amounts,* 175 y. 1 mo. 2 w. 5 d. 21 h. 55 m. 34 s.; 84 y. 3 m. 0 w. 2 d.

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# SUBTRACTION

## OF COMPOUND NUMBERS.

### ¶ 39. EXAMPLES FOR PRACTICE.

1. 136 £. 7 s. 6 d. 2 qrs. — 50 £. 10 s. 4 d. 3 qrs. = 85 £. 17 s. 1 d. 3 qrs., *Ans.*

2. 1256 £. 10 s. — 87 £. 10 s. 6 d. = 1168 £. 19 s. 6 d., *Ans.*

3. 27 £. — 19 £. 12 s. 8 d. 2 qrs. = 7 £. 7 s. 3 d. 2 qrs., *Ans.*

4. 13 gal. 3 qts. + 5 gal. 2 qts. 1 pt. = 19 gal. 1 qt. 1 pt.; then, 63 gal. — 19 gal. 1 qt. 1 pt. = 43 gal. 2 qts. 1 pt., *Ans.*

5. 118 gal. — 97 gal. 3 qts. 1 pt. = 20 gal. 0 qt. 1 pt., *Ans.*

6. 3 lb. 4 oz. — 5 oz. 7 pwt. 13 grs. = 2 lb. 10 oz. 12 pwt. 11 grs., *Ans.*

7. 15 lb. 2 oz. 5 pwt. — 9 oz. 8 pwt. 10 grs. = 14 lb. 4 oz. 16 pwt. 14 grs., *Ans.*

8. 2 cwt. 1 qr. 11 lb. 5 oz. + 2 qrs. 18 lb. 10 oz. + 25 lb. 6 oz. = 3 cwt. 0 qr. 27 lb. 5 oz.; then, 9 cwt. 2 qrs. 17 lb. — 3 cwt. 0 qr. 27 lb. 5 oz. = 6 cwt. 1 qr. 17 lb. 11 oz., *Ans.*

9. 10 yds. 3 qrs. 2 na. + 18 yds. 3 qrs. 3 na. = 29 yds. 3 qrs. 1 na.; then, 36 yds. 2 qrs. — 29 yds. 3 qrs. 1 na. = 6 yds., 2 qrs., 3 na., *Ans.*

10. 28 m. 5 fur. 16 r. — 15 m. 6 fur. 26 r. 12 ft. = 12 m. 6 fur. 29 r. 4½ ft., *Ans.*

11. 13 A. 3 roods + 14 A. 3 roods = 28 A. 2 roods; 26 A. 2 r. 27 p. + 45 A. 2 r. 33 p. = 72 A. 1 r. 20 p., from which — 28 A. 2 r. = 43 A. 3 r. 20 p., *Ans.*

Note. *In the above question,* (*Arithmetic,*) 6 *roods have* *been changed to* 3, *and* 5 *roods to* 2, (1842.) *So also, in the example following*, 5 *roods have been changed to* 3.

12. 64 A. 2 r. 11 p. 29 ft. — 26 A. 3 r. 34 p. 132 ft. = 37 A. 2 r. 16 p. 169¼ ft., *Ans.*

13. 8 cords, 76 cub. ft. + 5 c. 7 cord ft. (= 112 cub. ft.) = 14 cords, 60 cub. ft.; then, 21 cords — 14 cords, 60 cub. ft. = 6 cords, 68 cub. ft., *Ans.*

14. 365 days — (Jan. 1st. to July 4th, 3 o'clock, 20 min. P. M. =) 184 days, 15 h. 20 m. = 180 days, 8 h. 40 m., *Ans.*

15. 31 days — 3 d. 15 h. 20 m. (past time,) = 27 d. 8 h. 40 m. (future time;) then, 27 d. 8 h. 40 m. — 3 d. 15 h. 20 m. = 23 d. 17 h. 20 m., *Ans.*

17. 1825, 4th mo. 25th d. — 1823, 10th mo. 20th d. = 1 year, 6 m. 5 d., *Ans.*

18. 1819, 4 m. 2 d. — 1816, 9 m. 29 d. = 2 y. 6 m. 3 d., *Ans.*

19. 51° 32′ — 42° 23′ = 9° 9′, *Ans.*

20. 77° 43′ — 71° 3′ = 6° 40′, *Ans.*

21. 85° — 74° = 11°, *Ans.*

**¶ 40.** 2. 6° 40′ × 4 = 26 m. 40 s.; then, 3 h. + 26 m. 40 s. = 3 o'clock, 26 m. 40 s. P. M., *Ans.*

3. 155° — 72° = 83° × 4 = 332 m. = 5 hours, 32 m.; then, 6 h. 28 m. + 5 h. 32 m. = 12 o'clock at noon, *Ans.*

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# MULTIPLICATION & DIVISION

## OF COMPOUND NUMBERS.

### ¶ 41.

11. 3 £. 4 s. 6 d.
× 7
22 11 6, *Ans.*

12. *Reverse the foregoing process.*
7 ) 22 £. 11 s. 6 d.
3 4 6
*So in the following examples.*

13. 10 s. 6 d. × 5 = 2 £. 12 s. 6 d., *Ans.*

15. 2 bu. 3 pk. 6 qts. × 5 = 14 bu. 2 pk. 6 qts., *Ans.*

17. 4 yds. 1 qr. 3 na. × 9 = 39 yds. 3 qrs. 3 na., *Ans.*

19. 2 qts. 1 pt. 3 gills, × 7 = 5 gal. 0 qts. 0 pts. 1 gi. *Ans.*

21. 5 oz. 12 pwt. 17 grs. × 8 = 3 lb. 9 oz. 1 pwt. 16 grs., *Ans.*

23. 9 cwt. 3 qrs. 21 lb. × 12 = 119 cwt. 1 qr., *Ans.*

27. 2 £. 12 s. 4 d. × 4 = 10 £. 9 s. 4 d., which × 6 = 62 £. 16 s., *Ans.*

29. 8 × 7 × 2 = 112; therefore, 7 d. 1 qr. × 8 = 4 s. 10 d. × 7 = 1 £. 13 s. 10 d. × 2 = 3 £. 7 s. 8 d., *Ans.*

31. 7 × 12 = 84; then, 112 gal. 2 qts. 1 pt. 3 g. × 7 = 789 gal. 0 qts. 0 pts. 1 gill, which × 12 = 9468 gals. 1 qt. 1 pt., *Ans.*

### EXAMPLES FOR PRACTICE.

1. 4 s. 7 d. 2 qr. × 10 = 2 £. 6 s. 3 d., cost of 10 yards, which × 10 = 23 £. 2 s. 6 d., cost of 100 yds. × 3 = 69 £. 7 s. 6 d., cost of 300 yds.; 2 £. 6 s. 3 d. × 5 = 11 £. 11 s. 3 d., cost of 50 yds.; and 4 s. 7 d. 2 qr. × 9 = 2 £. 1 s. 7 d. 2 qr., cost of 9 yds.; then, 69 £. 7 s. 6 d. + 11 £. 11 s. 3 d. + 2 £. 1 s. 7 d. 2 qr. = 83 £. 0 s. 4 d. 2 qr., *Ans.*

3. 1 cwt. 3 qrs. 9 lb. × 10 = 18 cwt. 1 qr. 6 lb. in 10 barrels, which × 10 = 183 cwt. 0 qr. 4 lb. in 100 barrels, which × 2 = 366 cwt. 0 qr. 8 lb. contained in 200 barrels; 18 cwt. 1 qr. 6 lb. × 4 = 73 cwt. 0 qr. 24 lb. contained in 40 barrels; then, 366 cwt. 0 qr. 8 lb. + 73 cwt. 0 qr. 24 lb. + 1 cwt. 3 qr. 9 lb. (= 1 barrel) = 441 cwt. 0 qr. 13 lb., *Ans.*

5. 2 bu. 3 pks. × 3 = 8 bu. 1 pk. × 9 = 74 bu. 1 pk. × 5 = 371 bu. 1 pk., *Ans.*

7. 3 s. 10 d. 2 qr. × 8 × 7 × 2 = 21 £. 14 s., cost of 1 cwt., which × 5 × 7 (5 × 7 = 35) = 759 lb. 10 s., *Ans.*

9. 12 r. 6 ft. × 7½ (¶ 34, ex. 31, note) = 92 rods 12 feet, *Ans.*

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## SUPPLEMENT TO THE ARITHMETIC OF COMPOUND NUMBERS.

### ¶ 42. EXERCISES.

1. 3 oz. 5 pwt. × 3 × 6 = 4 lb. 10 oz. 10 pwt.; 15 pwt. 14 gr. × 4 × 6 = 1 lb. 6 oz. 14 pwt.; 9 oz. 7 pwt. × 3 = 2 lb. 4 oz. 1 pwt.; 1 lb. 9 oz. 15 pwt. × 2 = 3 lb. 7 oz. 10 pwt.; 11 oz. 18 pwt. × 6 = 5 lb. 11 oz. 8 pwt.; the several products added = 18 lb. 4 oz. 3 pwt., *Ans.*

2. 5 pwt. 6 gr. — 3 pwt. 17 gr. = 1 pwt. 13 grs., *Ans.*

3. 3 cwt. 2 qr. 9 lb. × 6 = 21 cwt. 1 qr. 26 lb., *Ans.*

4. $35 \times 27 = 945$ yards, *Ans.*

5. 45 gal. 3 qts. 1 pt. × 9 = 412 gals. 3 qts. 1 pt., *Ans.*

6. 31 cwt. 2 qrs. 20 lb. ÷ 4 = 7 cwt. 3 qrs. 19 lb., *Ans.*

7. 4 d. 2 qr. × 8 × 7 × 2 = 2 £. 2 s., cost of 1 cwt.; or, 4 d. 2 qr. = $\frac{1}{16}$ of a dollar; then, (¶ 29, ex. 10, note,) $112 \div 16 =$ \$ 7, cost of 1 cwt., *Ans.*

8. 18 £. 13 s. 4 d. ÷ 8 = 2 £. 6 s. 8 d., cost of 1 cwt.; and 2 £. 6 s. 8 d. ÷ 8 ÷ 7 ÷ 2 = 5 d. per lb., *Ans.*

9. 5 s. 9 d. × 8 × 7 × 2 = 32 £. 4 s. (cost per cwt.) × $9\frac{1}{4}$ = 297 £. 17 s., *Ans.*

10. ($6\frac{1}{2}$ cwt. = $\frac{13}{2}$ cwt.; therefore,) 72 £. 16 s. ÷ 13 = 5 £. 12 s., cost of $\frac{1}{2}$ cwt. or 56 lbs., which ÷ ($8 \times 7 = 56$) 8 ÷ 7 = 2 s., *Ans.*

11. $456 \div 8 = 57$ £., *Ans.*

12. $86 \div 2 = 43$ £. (cost at 10 s. per yard) which ÷ 2 = 21 £. 10, (cost at 5 s. per yard;) then, 43 £. + 21 £. 10 s. = 64 £. 10 s., *Ans.*

13. 7 s. 6 d. = 5 s. ($\frac{1}{4}$ £.) + 2 s. 6 d. ($\frac{1}{8}$ £. or $\frac{1}{2}$ of 5 s.;) therefore, 7846 lb. (supposing them so many £.,) ÷ 4 = 1961 £. 10 s., at 5 s. per lb., which ÷ 2 = 980 £. 15 s., at 2 s. 6 d. per lb.; then, 1961 £. 10 s. + 980 £. 15 s. = 2942 £. 5 s., cost at 7 s. 6 d. per lb.; 14 s. = 10 s. ($\frac{1}{2}$ £.) + 4 s. ($\frac{1}{5}$ £.) and 13 s. 4 d. = 10 s. ($\frac{1}{2}$ £.) + 3 s. 4 d. ($\frac{1}{6}$ £.), &c.

14. 2 qrs. = $\frac{1}{2}$ cwt.; therefore, \$ 94'25 ÷ 2 = \$ 47'12$\frac{1}{2}$, cost of 2 qrs.; once \$ 47'12$\frac{1}{2}$ + $\frac{1}{2}$ of \$ 47'12$\frac{1}{2}$ (= \$ 23'56$\frac{1}{4}$) = \$ 70'68$\frac{3}{4}$, cost of 3 qrs.; 14 lb. is $\frac{1}{2}$ of 1 qr.; therefore, \$ 23'56$\frac{1}{4}$ (cost of 1 qr.) ÷ 2 = \$ 11'78$\frac{1}{8}$, cost of 14 lb., &c.

15. 2 pks. = $\frac{1}{2}$ bushel, and 4 qts. = $\frac{1}{4}$ of 2 pecks; therefore, \$1'50 ÷ 2 = \$ '75, which ÷ 4 = \$ '18$\frac{3}{4}$; then, 75 cts. + 18$\frac{3}{4}$ cts. = 93$\frac{3}{4}$ cts., cost of 2 pks. 4 qts.

16. A meteor is transient in its appearance, and in all places where seen, must be seen at the same instant of time; the question, therefore, is the same as if it had been, "At 7 minutes past 9 o'clock, P. M., city of Washington, what is the time at Boston? at the Sandwich Islands?" The difference between the Washington and Boston time (26 m. 40 s.) must be added to the Washington time to find the Boston time, = 33 m. 40 s. past 9 o'clock in the evening; and the difference between the Washington and the Sandwich Island time (5 h. 9 m. 8 s.) must be subtracted from the Washington time, to give the Sandwich Island time, = 57 m. 52 s. past 3 o'clock, P. M., *Ans.*

[illegible]

# FRACTIONS.

## ¶ 49. EXAMPLES FOR PRACTICE.

2. $\frac{19}{20} \div 24 = \frac{19}{480}$ of an acre, *Ans.*

3. $\frac{10}{11} \div 12 = \frac{10}{132}$ of a dollar, *Ans.*

5. $\frac{4}{10} \div 12 = \frac{4}{120} = \frac{1}{30}$, *Ans.* $\frac{7}{40} \div 21 = \frac{7}{840} = \frac{1}{120}$, *Ans.* $\frac{36}{48} \div 24 = \frac{36}{1176} = \frac{3}{98}$, *Ans.*

7. $4\frac{11}{13} = \frac{63}{13} \div 9 = \frac{7}{13}$ of a dollar, *Ans.*

8. $12\frac{6}{7} = \frac{90}{7} \div 5 = \frac{18}{7} = 2\frac{4}{7}$, *Ans.*

9. $14\frac{3}{4} = \frac{59}{4} \div 8 = \frac{59}{32} = 1\frac{27}{32}$, *Ans.*

11. $2786\frac{1}{4} \div 6 = 464$, and $2\frac{1}{4}$ remain $= \frac{9}{4} \div 6 = \frac{9}{24} = \frac{3}{8}$; then, $464 + \frac{3}{8} = 464\frac{3}{8}$, *Ans.*

12. $7646\frac{11}{24} \div 24 = 318$, rem. $14\frac{11}{24} = \frac{347}{24} \div 24 = \frac{347}{576}$; then, $318 + \frac{347}{576} = 318\frac{347}{576}$, *Ans.*

13. $462\frac{1}{3} \div 3 = 154\frac{1}{9}$, *Ans.*

## ¶ 51. EXAMPLES FOR PRACTICE.

1. $\frac{5}{36} \times 18 =$ (divide the denominator) $\frac{5}{2} = 2\frac{1}{2}$ barrels. $\frac{5}{36} \times 6 = \frac{5}{6}$ barrel. $\frac{5}{36} \times 9 = \frac{5}{4} = 1\frac{1}{4}$ barrels, *Ans.*

2. $\frac{71}{120} \times 40 = \frac{71}{3} = 23\frac{2}{3}$, *Ans.*

3. $\frac{13}{144} \times 12 = \frac{13}{12} = 1\frac{1}{12}$; $\frac{13}{144} \times 18 = \frac{13}{8} = 1\frac{5}{8}$; $\frac{13}{144} \times 21 = \frac{273}{144} = 1\frac{129}{144}$; $\frac{13}{144} \times 36 = \frac{13}{4} = 3\frac{1}{4}$; $\frac{13}{144} \times 48 = \frac{13}{3} = 4\frac{1}{3}$; $\frac{13}{144} \times 60 = 7\frac{80}{144} = 5\frac{60}{144} = 5\frac{5}{12}$; or multiply by the component parts, $12 \times 5 = 60$, as shown in the Arithmetic, *Ans.*

5. $9 \times 17 = \$153$, and $\frac{13}{20} \times 17 = \frac{221}{20} = \$11\frac{1}{20}$; then, $\$153 + \$11\frac{1}{20} = \$164\frac{1}{20}$, *Ans.*

6. $2\frac{6}{40} \times 5 = 10\frac{6}{8}$ m.; $2\frac{6}{40} \times 8 = 16\frac{6}{5} = 17\frac{1}{5}$ m.; $2\frac{6}{40} \times 12 = 24\frac{72}{40} = 25\frac{32}{40}$ miles, *Ans.*

## ¶ 52. EXAMPLES FOR PRACTICE.

2. $40 \times \frac{3}{4} = (40 \times 3 = 120$, which $\div 4 =)$ \$30, *Ans.*

3. $24 \times \frac{3}{8} = (24 \times 3 = 72$, which $\div 8 =)$ \$9, *Ans.*

4. $90 \times \frac{1}{2} = 45$; $369 \times \frac{2}{3} = 246$; $45 \times \frac{7}{10} = 31\frac{5}{10} = 31\frac{1}{2}$, *Ans.*

5. $45 \times \frac{7}{10} = 31\frac{1}{2}$; $20 \times \frac{1}{2} = 10$, *Ans.*

## ¶ 53. EXAMPLES FOR PRACTICE.

2. $\frac{3}{4} \times \frac{2}{3} = \frac{6}{12} = \frac{1}{2}$ dollar, *Ans.*

3. $\frac{7}{8} \times \frac{6}{7} = \frac{42}{56} = \frac{3}{4}$, *Ans.*

5. In this example, 4, 5, 6, 7, 8, and 9, are found both among the numerators and the denominators; therefore drop them, and there remain $\frac{3}{10}$, *Ans.*

6. $\frac{7}{1} \times \frac{1}{2} \times \frac{5}{7} \times \frac{3}{8} \times (3\frac{1}{9} =) \frac{28}{9} = \frac{2940}{1008} = 2\frac{11}{12}$, *Ans.*

7. $\frac{6}{25} \times \frac{7}{8} = \frac{42}{200} = \frac{21}{100}$ of a dollar, *Ans.*

9. $\frac{5}{6} \times 7\frac{3}{4} (= \frac{31}{4}) = \frac{155}{24} = 6\frac{11}{24}$ dollars, *Ans.*

10. $2\frac{1}{4} (= \frac{9}{4}) \times 6\frac{5}{8} (= \frac{53}{8}) = \frac{477}{32} = \$\,14\frac{29}{32}$, *Ans.*

11. $\frac{3}{1} \times \frac{2}{5} \times (\frac{5}{9}$ of $\frac{3}{4} =) \frac{15}{36} \times (2\frac{5}{7} =) \frac{19}{7} \times (\frac{11}{12}$ of $\frac{6}{7}$ of $\frac{4}{5} =) \frac{264}{420} = \frac{451440}{529200} = \frac{209}{245}$, *Ans.*

## ¶ 54. EXAMPLES FOR PRACTICE.

3. $2\frac{9}{10} (= \frac{29}{10}) \times 3 = \frac{87}{10} = 8\frac{7}{10}$ tons, or (multiplying the integers and the fraction separately) $2 \times 3 = 6$, and $\frac{9}{10} \times 3 = \frac{27}{10} = 2\frac{7}{10}$; then, $2\frac{7}{10} + 6 = 8\frac{7}{10}$ tons, &c.

4. $8\frac{7}{12} \times 3 = \$\,25\frac{3}{4}$, *Ans.*

5. $\$\,14\frac{3}{4} \times 147 = \$\,2168\frac{1}{4}$, *Ans.*

6. $\$\,1000 \times \frac{3}{5} (\div 5 = \$\,200$, or $\frac{1}{5}$, which $\times 3) = \$\,600$, or $\frac{3}{5}$, which is A's share; $\$\,1000 \times (\frac{6}{15} =) \frac{2}{5}$ ($\div 5$, &c., as before) $= \$\,400$, which is B's share.

7. ($\frac{1}{2}$ of $\frac{2}{3}$, dropping the 2's $=$) $\frac{1}{3} \times$ ($\frac{3}{4}$ of $\frac{4}{5}$, dropping the 4's $=$) $\frac{3}{5}$; (then, dropping the 3's,) $= \frac{1}{5}$, *Ans.*

12. $(\frac{1}{9}$ of $\frac{8}{1} =) \frac{8}{9} \times (\frac{2}{3}$ of $\frac{7}{1} =) \frac{14}{3} \times (\frac{3}{8}$ of $\frac{9}{1} =) \frac{27}{8} \times (\frac{1}{7}$ of $\frac{10}{1} =) \frac{10}{7}$ (dropping the 8's) $= \frac{3780}{189} = 20$, *Ans.*

## ¶ 56. EXAMPLES FOR PRACTICE.

1. $7 \div \frac{1}{2} = (7 \times 2 = 14$, which $\div 1 =)$ 14 times, *Ans.*

2. $26 \div \frac{1}{4} = 104$ times, *Ans.*

3. $3 \div \frac{3}{4} = (3 \times 4 = 12$, which $\div 3 =) 4$; $6 \div \frac{2}{3} = 9$; $10 \div \frac{2}{5} = 25$, *Ans.*

4. (3 gal. $=$) 12 quarts $\div \frac{9}{16} = (12 \times 16 = 192$, which $\div 9 =)$ $21\frac{3}{9}$ days, *Ans.*

5. $22 \div (2\frac{3}{4} =) \frac{11}{4} = (22 \times 4 = 88$, which $\div 11 =)$ 8 acres, *Ans.*

6. $37 \div (4\frac{2}{5} =) \frac{22}{5} = (\times 5$ and $\div 22 =) 8\frac{9}{22}$ yds, *Ans.*
8. $6 \div \frac{36}{5} = (\times 5$ and $\div 36 =) \frac{5}{6}$ of 1 time, *Ans.*
9. $53 \div (8\frac{5}{9} =) \frac{77}{9} = (\times 9$ and $\div 77 =) 6\frac{15}{77}$ times, *Ans.*
10. $87 \div \frac{5}{6} = 104\frac{2}{5}$ rods, *Ans.*

## ¶ 57. EXAMPLES FOR PRACTICE.

2. $\frac{7}{8} \div \frac{1}{4}$ (inverting the divisor) $\frac{4}{1}$ of $\frac{7}{8} = \frac{28}{8} = 3\frac{1}{2}$ bushels, *Ans.*
4. $\frac{7}{8} \div \frac{3}{16} = (\frac{16}{3}$ of $\frac{7}{8} =) \frac{112}{24} = 4\frac{16}{24} = 4\frac{2}{3}$ bushels, *Ans.*
5. $(36\frac{7}{8} =) \frac{295}{8} \div (4\frac{3}{5} =) \frac{23}{5} (\frac{5}{23}$ of $\frac{295}{8}) = \frac{1475}{184} = 8\frac{3}{184}$ weeks, *Ans.*
8. $(2\frac{1}{4} =) \frac{9}{4} \div (1\frac{1}{2} =) \frac{3}{2} = \frac{18}{12} = 1\frac{1}{2}$, *Ans.*; $(10\frac{3}{8} =) \frac{83}{8} \div (2\frac{1}{8} =) \frac{17}{8} = \frac{664}{136} = 4\frac{15}{17}$, *Ans.*
9. $\frac{2}{5} \div \frac{1}{10} (\frac{10}{1}$ of $\frac{2}{5}) = \frac{20}{5} = 4$, *Ans.*
10. $(4\frac{7}{8} =) \frac{39}{8} \div \frac{3}{7} (\frac{7}{3}$ of $\frac{39}{8}) = \frac{273}{24} = 11\frac{3}{8}$, *Ans.*
11. $(\frac{2}{3}$ of $\frac{3}{4} =) \frac{6}{12} = \frac{1}{2} \div (\frac{7}{8}$ of $\frac{1}{7} =) \frac{7}{56} = \frac{1}{8} (\frac{8}{1}$ of $\frac{1}{2}) = \frac{8}{2} = 4$, *Ans.*

## ¶ 58. EXAMPLES FOR PRACTICE.

NOTE. *In the first six of the following examples, let the pupil consult ¶ 57, ex. 3, and make the several distinctions.*

1. \$ $\frac{63}{100}$ (cost) $\div$ (¶ 49) 7 lb. (the quantity) = \$ $\frac{9}{100}$, the price of unity, or 1 lb., *Ans.*
2. \$ $\frac{1}{8}$ (cost) $\div \frac{3}{8}$ barrel (the quantity) = (¶ 57, $\frac{8}{3}$ of \$ $\frac{1}{8}$ =) \$ $\frac{8}{24}$ = \$ $\frac{1}{3}$, the price of unity, or 1 barrel, &c.
3. \$ $\frac{7}{8} \div 4$ (¶ 49) = \$ $\frac{7}{32}$, *Ans.*
4. \$ $4 \div \frac{7}{8}$ yd. (¶ 55) = \$ $4\frac{4}{7}$, *Ans.*
5. \$ $75 \div (14\frac{3}{8}$ yds. $=) \frac{115}{8}$ yds. $(\times 8$ and $\div 115) =$ \$ $5\frac{25}{115} = \frac{5}{23}$, *Ans.*
6. (\$ $31\frac{1}{2}$ =) \$ $\frac{63}{2} \div (10\frac{1}{2}$ bar. $=) \frac{21}{2}$ bar. $(\frac{2}{21}$ of $\frac{63}{2}) =$ \$ $\frac{126}{42}$ = \$ 3 per barrel, *Ans.*
7. $746 \div \frac{3}{8} (\times 8$ and $\div 3) = 1989\frac{1}{3}$ times, *Ans.*
8. $(\frac{1}{2}$ of $\frac{2}{3} =) \frac{2}{6} = \frac{1}{3} \div \frac{3}{4} (\frac{4}{3}$ of $\frac{1}{3}) = \frac{4}{9}$; $\frac{7}{8} \div (\frac{4}{7}$ of $\frac{2}{5} =) \frac{8}{35} (\frac{35}{8}$ of $\frac{7}{8}) = \frac{245}{64} = 3\frac{53}{64}$, *Ans.*
9. $(\frac{1}{2}$ of $\frac{4}{5} =) \frac{4}{10} \div (\frac{5}{6}$ of $\frac{2}{3} =) \frac{10}{18} (\frac{18}{10}$ of $\frac{4}{10}) = \frac{72}{100} = \frac{18}{25}$, *Ans.*
10. $(\frac{1}{5}$ of $\frac{4}{1} =) \frac{4}{5} \div \frac{4}{15} (\frac{15}{4}$ of $\frac{4}{5}) = \frac{60}{20} = 3$, *Ans.*

11. $(4\frac{5}{9} =)\ \frac{41}{9} \div (\frac{5}{9}$ of $\frac{4}{1} =)\ \frac{20}{9}\ (\frac{9}{20}$ of $\frac{41}{9}) = \frac{369}{180} = 2\frac{9}{180} = 2\frac{1}{20}$, *Ans.*

12. $(\frac{5}{9}$ of $\frac{4}{1} =)\ \frac{20}{9} \div (4\frac{5}{9} =)\ \frac{41}{9}\ (\frac{9}{41}$ of $\frac{20}{9}$, dropping the 9's) $= \frac{20}{41}$, *Ans.*

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## ADDITION AND SUBTRACTION OF FRACTIONS.

### ¶ 62. EXAMPLES FOR PRACTICE.

NOTE. Let the pupil be thoroughly drilled by the teacher in the three preceding sections before attempting to work the following examples by himself.

1. $\frac{6}{7}$ (multiplying both terms by 3) $= \frac{18}{21}$, and $\frac{2}{3}\ (\times 7) = \frac{14}{21}$; then, $\frac{18}{21} + 4\frac{14}{21} + 12 = 16\frac{32}{21} = 17\frac{11}{21}$, *Ans.*

2. Whole ticket $= \frac{8}{8}$; $\frac{3}{4}$ of $\frac{1}{2} = \frac{3}{8}$; then, $\frac{8}{8} - \frac{3}{8} = \frac{5}{8}$, *Ans.*

3. The least common multiple (¶ 61) of 2, 8, 4, 10, 5, 20, is 40; then, (¶ 61, ex. 7,) $\frac{20}{40} + \frac{25}{40} + \frac{10}{40} + \frac{28}{40} + \frac{8}{40} + \frac{28}{40} = 2\frac{39}{40}$, *Ans.*

4. When the numbers are small, fractions are readily reduced to a common denominator *mentally*, without the formality of a written operation. Thus, in this example, the fraction $\frac{8}{11}$ is readily reduced to 33ds, considering both terms to be multiplied by 3; we then have $16\frac{7}{33} - 14\frac{24}{33} = 1\frac{16}{33}$, *Ans.*

5. $1\frac{1}{2} = 1\frac{2}{4} - \frac{3}{4} = \frac{3}{4}$; or $1\frac{1}{2} = \frac{6}{4} - \frac{3}{4} = \frac{3}{4}$, *Ans.*

6. $3 = \frac{9}{3} - \frac{1}{3} = \frac{8}{3} = 2\frac{2}{3}$, *Ans.*

7. $147\frac{1}{3} = 147\frac{3}{9} - 48\frac{4}{9} = 98\frac{8}{9}$, *Ans.*

8. $\frac{1}{4}$ of $\frac{4}{10} = \frac{4}{40} = \frac{1}{10}$, and $\frac{1}{2}$ of $\frac{2}{47} = \frac{2}{94} = \frac{1}{47}$; reduce to a common denominator, (¶ 60;) then, $\frac{47}{470} - \frac{10}{470} = \frac{37}{470}$, *Ans.*

9. $112\ (\frac{1}{2} =)\ \frac{6}{12} + 311\ (\frac{2}{3} =)\ \frac{8}{12} + 1000\ (\frac{3}{4} =)\ \frac{9}{12} = 1424\frac{11}{12}$, *Ans.*

10. $14 + 11 + 4\ (\frac{2}{3} =)\ \frac{12}{18} + \frac{1}{18} + (\frac{1}{2} =)\ \frac{9}{18} = 30\frac{2}{9}$, *Ans.*

11. $\frac{3}{4} - (\frac{1}{2} =)\ \frac{2}{4} = \frac{1}{4}$; $\frac{7}{8} - (\frac{3}{4} =)\ \frac{6}{8} = \frac{1}{8}$, *Ans.*

12. $(\frac{1}{2} =)\ \frac{3}{6} - (\frac{1}{3} =)\ \frac{2}{6} = \frac{1}{6}$; $(\frac{2}{3} =)\ \frac{4}{6} - (\frac{1}{2} =)\ \frac{3}{6} = \frac{1}{6}$, &c.

13. $(1 =)\ \frac{4}{4} - \frac{1}{4} = \frac{3}{4}$; $(3\frac{4}{5} =)\ \frac{19}{5} = \frac{38}{10} - \frac{1}{10} = \frac{37}{10} = 3\frac{7}{10}$; $(1000 =)\ \frac{10000}{10} - \frac{1}{10} = \frac{9999}{10} = 999\frac{9}{10}$, *Ans.*

## ¶ 63. REDUCTION OF FRACTIONS.

5. $\frac{5}{2688}$ guin. $\times 28 = \frac{140}{2688}$ s. $\times 12 = \frac{1680}{2688} = \frac{5}{8}$ d., *Ans.*

6. *Reverse the foregoing process;* thus, $\frac{5}{8}$ d. $\div 12 = \frac{5}{96}$ s. $\div 28 = \frac{5}{2688}$ guin., *Ans.* So in the succeeding examples.

7. $\frac{4}{7}$ guin. $\times 28 = \frac{112}{7}$ s. $\div 20 = \frac{112}{140} = \frac{4}{5}$ £., *Ans.*

9. $\frac{3}{4}$ moid. $\times 36 = \frac{108}{4}$ s. $\div 28 = \frac{108}{112} = \frac{27}{28}$ guin., *Ans.*

11. $\frac{2}{27}$ lb. Troy $\times 12 = \frac{24}{27} = \frac{8}{9}$ oz., *Ans.*

13. $\frac{1}{28}$ lb. av. $\times 16 = \frac{16}{28} = \frac{4}{7}$ oz., *Ans.*

15. $\frac{1}{728}$ hhd. $\times 63 = \frac{63}{728}$ gal. $\times 4 = \frac{252}{728}$ qt. $\times 2 = \frac{504}{728} = \frac{9}{13}$ pt., *Ans.*

17. $\frac{1}{3960}$ m. $\times 320 = \frac{320}{3960}$ r. $\times 16\frac{1}{2} = \frac{5280}{3960} = \frac{16}{12} = 1\frac{1}{3}$ ft., *Ans.*

19. $\frac{2}{9}$ of $\frac{1}{6}$ £. $= \frac{2}{54} = \frac{1}{27}$ £. NOTE. $\frac{1}{27}$ £. is a composite number, of which $\frac{2}{9}$ is one of the factors, and $\frac{1}{6}$, the other. This it is proper to regard in order to a ready solution of the examples which follow. Then $\frac{1}{27}$ £. $\times 20 = \frac{20}{27}$ s., *Ans.*

20. $\frac{20}{27}$ s. $\div 20 = \frac{1}{27}$ £. Now, $\frac{1}{27}$ £. being a composite number, and $\frac{2}{9}$ £. one of the component parts, as first shown, therefore, $\frac{1}{27}$ £. $\div \frac{2}{9}$, one of the factors, ($\frac{9}{2}$ of $\frac{1}{27}$) $= \frac{9}{54} = \frac{1}{6}$ £., the other factor, that is, $\frac{2}{9}$ of $\frac{1}{6}$ £., *Ans.*

21. $\frac{1}{8}$ of $\frac{2}{11}$ of $\frac{3}{1}$ £. (three factors) $= \frac{6}{88} = \frac{3}{44}$ £. $\times 20 = \frac{60}{44}$ s. $\times 12 = \frac{720}{44} = \frac{180}{11}$ d., *Ans.*

22. 1*st question.* $\frac{180}{11}$ d. $\div 12 = \frac{15}{11}$ s. $\div 20 = \frac{15}{220}$ £. $\div \frac{1}{8}$ £. one of the factors, $=$ ($\frac{8}{1}$ of $\frac{15}{220} =$) $\frac{120}{222}$ £. $\div \frac{3}{1}$ £., another of the factors, $=$ ($\frac{1}{3}$ of $\frac{120}{220} =$) $\frac{120}{660} = \frac{2}{11}$ £.; the other factor, that is, $\frac{2}{11}$ of $\frac{1}{8}$ of 3 £., *Ans.* Or the factors $\frac{1}{8}$ £. and 3 £. may be multiplied together; then only one operation of division will be necessary; then, $\frac{1}{8}$ of $\frac{3}{1} = \frac{3}{8}$ £.; then, $\frac{15}{222}$ £. $\div \frac{3}{8}$ £. ($\frac{8}{3}$ of $\frac{15}{220}$) $= \frac{120}{660} = \frac{2}{11}$ £., as before.

2*d question.* $\frac{180}{11}$ d. (as before shown,) $= \frac{15}{220}$ £., which $\div \frac{2}{11}$ £. ($\frac{11}{2}$ of $\frac{15}{220}$) $= \frac{165}{440}$ £. $\div$ (3 £. $=$) $\frac{3}{1}$ £. ($\frac{1}{3}$ of $\frac{165}{440}$) $= \frac{165}{1320} = \frac{1}{8}$ £., that is, $\frac{2}{11}$ of $\frac{1}{8}$ of 3 £., *Ans.*

3*d question.* $\frac{180}{11}$ d. $= \frac{15}{220}$ £. $\div \frac{1}{8}$ £. ($\frac{8}{1}$ of $\frac{15}{220}$) $= \frac{120}{220}$ £. $\div \frac{2}{11}$ £. ($\frac{11}{2}$ of $\frac{120}{220}$) $= \frac{1320}{440} = 3$ £., that is, $\frac{1}{8}$ of $\frac{2}{11}$ of 3 £., *Ans.*

## ¶ 64. EXAMPLES FOR PRACTICE.

5. $\frac{3}{5}$ lb. $\times 12 = \frac{36}{5}$ oz. $= 7$ oz. and $\frac{1}{5}$ oz., which $\times 20 = \frac{20}{5}$ pwt. $= 4$ pwt. *Ans.* 7 oz. 4 pwt.

6. 7 oz. × 20 = 140 pwt. + 4 pwt. = 144 pwt., the numerator; 1 lb. × 12 = 12 oz. × 20 = 240 pwt., the denominator; then, $\frac{144}{244} = \frac{3}{5}$ lb., *Ans.*

7. $\frac{5}{9}$ lb. × 16 = $\frac{80}{9}$ oz. = 8 oz. and $\frac{8}{9}$ oz., which × 16 = $\frac{128}{9}$ dr. = $14\frac{2}{9}$ dr. *Ans.* 8 oz. $14\frac{2}{9}$ dr.

8. 8 oz. × 16 = 128 dr. + $14\frac{2}{9}$ dr. = $142\frac{2}{9}$ dr. = $\frac{1280}{9}$ dr.; 1 lb. × 16 = 16 oz. × 16 = 256 dr. = $\frac{2304}{9}$ dr.; then, $\frac{1280}{2304}$ = $\frac{5}{9}$ lb., *Ans.*

9. $\frac{4}{5}$ month × 4 = $\frac{16}{5}$ w. = 3 w. and $\frac{1}{5}$ w., which × 7 = $\frac{7}{5}$ d. = 1 d. and $\frac{2}{5}$ d., which × 24 = $\frac{48}{5}$ h. = 9 h. and $\frac{3}{5}$ h., which × 60 = $\frac{180}{5}$ minutes = 36 m. *Ans.* 3 w. 1 d. 9 h. 36 m.

*Omitting the multipliers, and presenting the work in a more condensed form.*

10. 3 weeks = 21 d. + 1 d. = 528 h. + 9 h. = 32220 m. + 36 m. = 32256 m.; 1 month = 40320 m.; then, $\frac{32256}{40320}$ = $\frac{4}{5}$ mo., *Ans.*

11. $\frac{4}{7}$ mile = 4 fur. and $\frac{4}{7}$ f. = 125 yds. and $\frac{5}{7}$ yd. = 2 ft. and $\frac{1}{7}$ ft. = 1 in. and $\frac{5}{7}$ in. = $2\frac{1}{7}$ bar. *Ans.* 4 fur. 125 y. 2 ft. 1 in. $2\frac{1}{7}$ bar.

12. 4 fur. = 880 yds. + 125 y. = 3015 ft. + 2 ft. = 36204 in. + 1 in. = 108615 bar. + $2\frac{1}{7}$ bar. = $\frac{760320}{7}$ bar.; 1 mile = $\frac{1330560}{7}$ bar.; then, $\frac{760320}{1330560}$ = $\frac{4}{7}$ mile, *Ans.*

13. $\frac{7}{16}$ acre = 1 rood and $\frac{12}{16}$ r. = 30 poles. *Ans.* 1 rood, 30 p.

14. 1 rood = 40 p. + 30 = 70 poles; 1 acre = 160 p.; then, $\frac{70}{160} = \frac{7}{16}$ acre, *Ans.*

15. $\$\frac{15}{16}$ = 5 s. and $\frac{5}{8}$ s. = $7\frac{1}{2}$ d. *Ans.* 5 s. $7\frac{1}{2}$ d.

16. 5 s. = 60 d. + $7\frac{1}{2}$ d. = $\frac{135}{2}$ d.; \$1 = 72 d. = $\frac{144}{2}$ d.; then, $\frac{135}{144} = \$\frac{15}{16}$, *Ans.*

17. $\frac{9}{10}$ yd. = 2 ft. and $\frac{7}{10}$ ft. = 8 in. and $\frac{2}{5}$ in. = $1\frac{1}{5}$ bar. *Ans.* 2 ft. 8 in. $1\frac{1}{5}$ bar.

18. 2 ft. = 24 in. + 8 in. = 96 bar. + $1\frac{1}{5}$ bar. = $\frac{486}{5}$ bar.; 1 yd. = $\frac{540}{5}$ bar.; then, $\frac{486}{540} = \frac{7}{10}$ yd., *Ans.*

19. $\frac{3}{13}$ T. = 4 cwt. and $\frac{8}{13}$ cwt. = 2 qr. and $\frac{6}{13}$ qr. = 12 lb. and $\frac{12}{13}$ lb. = 14 oz. and $\frac{10}{13}$ oz. = $12\frac{4}{13}$ dr. *Ans.* 4 cwt. 2 qr. 12 lb. 14 oz. $12\frac{4}{13}$ dr.

20. 4 cwt. = 16 qr. + 2 qr. = 504 lb. + 12 lb. = 8256 oz. + 14 oz. = 132320 dr. + $12\frac{4}{13}$ dr. = $\frac{1720320}{13}$ dr.; 1 ton = $\frac{7454720}{13}$ dr.; then, $\frac{1720320}{7454720} = \frac{3}{13}$ ton, *Ans.*

21. $\frac{9}{14}$ guin. = 18 s., *Ans.*

22. 3 roods = 120 p. + $17\frac{1}{2}$ p. = $\frac{275}{2}$ p.; 1 ac. = $\frac{320}{2}$ p.; then, $\frac{275}{320} = \frac{55}{64}$ ac., *Ans.*

23. 27 gal. = 108 qts. + 3 qts. = 222 pts. + 1 pt. = 223 pts.; 1 hhd = 504 pts.; then, $\frac{223}{504}$ hhd., *Ans.*

24. $\frac{5}{13}$ of $\frac{7}{1} = \frac{35}{13}$ cwt. = 2 cwt. and $\frac{9}{13}$ cwt. = 2 qrs. and $\frac{10}{13}$ qr. = 21 lb. and $\frac{7}{13}$ lb. = $8\frac{8}{13}$ oz. *Ans.* 2 cwt. 2 qrs. 21 lb. $8\frac{8}{13}$ oz.

*The foregoing reversed.* 2 cwt. 2 qrs. 21 lb. $8\frac{8}{13}$ oz. is $\frac{5}{13}$ of how many cwt.? 2 cwt. = 8 qrs. + 2 qrs. = 280 lb. + 21 lb. = 4816 oz. + $8\frac{8}{13}$ oz. = $\frac{62720}{13}$ oz.; 1 cwt. = $\frac{23296}{13}$ oz.; then, $\frac{62720}{23296} \div \frac{5}{13} = \frac{815360}{116480}$ cwt. = 7 cwt., that is, $\frac{5}{13}$ of 7 cwt., *Ans.*

25. 13 h. = 780 m. + 42 m. = 49320 s. + $51\frac{3}{7}$ s. = $\frac{345600}{7}$ s.; 1 day = $\frac{604800}{7}$ s.; then, $\frac{3456}{6048} = \frac{4}{7}$ day, *Ans.*

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## SUPPLEMENT TO FRACTIONS.

1. $\frac{5}{6} = \frac{40}{481}$, and $\frac{3}{8} = \frac{18}{48}$ (making the reduction to a common denominator *mentally;*) then $\frac{40}{48} + \frac{18}{48} = \frac{58}{48} = 1\frac{10}{48}$, &c.

2. $\frac{7}{8}$ £. = $\frac{140}{8} = \frac{70}{4}$ s. + $\frac{3}{4}$ s. = $\frac{73}{4} = 18\frac{1}{4}$ s., *Ans.*

3. $\frac{5}{6}$ days = $\frac{120}{6}$ h. = $\frac{480}{24}$ h. + ($\frac{3}{4}$ =) $\frac{18}{24}$ h. = $\frac{498}{24}$ h. = $20\frac{18}{24}$ h.; (1 day =) 24 h. = $\frac{576}{24}$ h.; then, $\frac{498}{576} = \frac{83}{96}$ of a day, *Ans.*

4. $\frac{1}{2}$ lb. = $\frac{12}{2}$ oz. = $\frac{72}{12}$ oz. + $\frac{7}{12}$ oz. = $\frac{79}{12}$ oz. = 6 oz. 11 pwt. 16 grs., *Ans.*

5. $\frac{1}{4} = \frac{2}{8} - \frac{1}{8} = \frac{1}{8}$; $\frac{3}{10}$ — ($\frac{1}{5}$ =) $\frac{2}{10} = \frac{1}{10}$; $\frac{3}{14}$ and $\frac{8}{40}$ are not so readily reduced to a common denominator *mentally;* therefore proceed as directed ¶ 60, and we have $\frac{120}{560} - \frac{112}{560} = \frac{8}{560}$, &c., *last*, $\frac{109}{110}$ — $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4} = \frac{6}{24} = \frac{1}{4}$ = (¶ 60) $\frac{436}{440} - \frac{110}{440} = \frac{326}{440} = \frac{163}{220}$, *Ans.*

6. $\frac{1}{2}$ s. = $\frac{12}{2}$ d. = $\frac{24}{4}$ d. — $\frac{3}{4}$ d. = $\frac{21}{4} = 5\frac{1}{4}$ d., *Rem.*

7. $\frac{3}{5}$ oz. = $\frac{60}{5} = \frac{480}{40}$ pwt. — ($\frac{7}{8}$ =) $\frac{35}{40}$ pwt. = $\frac{445}{40}$ pwt. = 11 pwt. 3 grs., *Ans.*

8. 4 days = 96 h. + $7\frac{1}{2}$ h. = $103\frac{1}{2}$ h. = $\frac{207}{2}$ h. = $\frac{1863}{18}$ h. — (1 d. $9\frac{3}{18}$ h. = $33\frac{3}{18}$ h. =) $\frac{597}{18}$ h. = $\frac{1266}{18}$ h. = 70 h. (= 2 d. 22 h.) 20 m., *Ans.*

9. $\frac{3}{4}$ of \$ $\frac{5}{8}$ = \$ $\frac{15}{32}$, *Ans.*

¶ **65.** 2. $\frac{1}{7}$ of $\frac{3}{4}$ = \$ $\frac{3}{28}$, cost of 1 lb., × 4 = \$ $\frac{12}{28}$, cost of 4 lb., × 3 (3 × 4 = 12) = \$ $\frac{36}{28}$ = \$ $1\frac{2}{7}$, cost of 12 lb.

3. If $6\frac{1}{2} = 6\frac{2}{4} = \frac{26}{4}$ yd. cost $\$3$, $\frac{1}{4}$ yd. will cost $\frac{1}{26}$ of $\$\frac{3}{1} = \$\frac{3}{26}$; $9\frac{1}{4} = \frac{37}{4}$ yds. will cost 37 times as much, $= \frac{111}{26} = \$4‘269 +$, *Ans.*

4. (¶ 65.) $\$2‘24 \div 2 = \$1‘12 \times \frac{3}{4} = \$0‘84$; or, by *analysis*, If 2 oz. $= \frac{8}{4}$ oz. cost $\$2‘24$, $\frac{1}{4}$ oz. will cost $\frac{1}{8}$ of $\$2‘24 = \$0‘28$, (cost of $\frac{1}{4}$ oz.,) and $\frac{3}{4}$ oz. will cost 3 times as much $= \$0‘84$, *Ans.*, as before.

5. If $\frac{5}{7}$ oz. cost $\$\frac{11}{12}$, $\frac{1}{7}$ will cost $\frac{1}{5}$ of $\$\frac{11}{12} = \$\frac{11}{60}$, and $\frac{7}{7}$ will cost 7 times as much $= \$\frac{77}{60} = \$1‘283 +$, cost of 1 oz., *Ans.*

6. If $\frac{1}{3} = \frac{2}{6} - \frac{1}{6} = \frac{1}{6}$ lb. cost $13\frac{1}{5} = \frac{66}{5}$ d., then 1 lb. $(= \frac{6}{6})$ will cost 6 times as much, $= \frac{396}{5}$ d.; 14 lb. $= \frac{14}{1} = \frac{70}{5}$ lb. — ($\frac{1}{5}$ of $\frac{2}{1} =$) $\frac{2}{5} = \frac{68}{5} \times \frac{396}{5}$ d. (cost of 1 lb.) $= \frac{26928}{25}$ d. $=$ 4 £. 9 s. $9\frac{3}{25}$ d., *Ans.*

7. $\frac{1}{5}$ yd. will cost $\frac{1}{3}$ of $\frac{7}{8} = \$\frac{7}{25} \times 5 = \$\frac{35}{24}$ (cost of 1 yd.) $\times 40\frac{1}{2} = \frac{81}{2}$ yd. $= \$\frac{2835}{48} = \$59‘062 +$, *Ans.*

8. If $\frac{7}{16} = \frac{14}{32}$ of the ship cost $\$251$, then $\frac{1}{32}$ part of it will cost $\frac{1}{14}$ of $\$\frac{251}{1} = \$\frac{251}{14}$, and $\frac{3}{32}$ of it will cost 3 times as much, $= \$\frac{753}{14} = \$53‘785 +$, *Ans.*

9. 1 cwt. $=$ 112 lb.; then 1 lb. will cost $\frac{1}{112}$ of ($3\frac{5}{8}$ £. $=$) $\frac{29}{8}$ £. $= \frac{29}{896}$ £.; and $9\frac{2}{3} = \frac{29}{3}$ lb. will cost $\frac{29}{3}$ as much, that is, $\frac{29}{3}$ of $\frac{29}{896}$ £. $= \frac{841}{2688}$ £. $=$ 6 s. $3\frac{5}{56}$ d., *Ans.*

10. $\frac{2}{3}$ of $\frac{4}{5} = \frac{8}{15} =$ the part of the vessel sold; then, if $\frac{8}{15}$ of the vessel cost $\$957$, $\frac{1}{15}$ of it will cost $\frac{1}{8}$ of $\$\frac{957}{1} = \$\frac{957}{8}$, and $\frac{15}{15}$ will cost 15 times as much $= \$\frac{14355}{8} = \$1794‘375$, *Ans.*

11. If $\frac{5}{8}$ yd. $\times 4 = \frac{20}{8}$ qr. $\div 5 = \frac{4}{8}$ E. E. $= \frac{1}{2} = \frac{15}{30}$ E. E. cost $\frac{5}{7}$ £., then $\frac{1}{30}$ E. E. will cost $\frac{1}{15}$ of $\frac{5}{7}$ £. $= \frac{5}{105}$ £., and $(\frac{9}{15}) = \frac{18}{30}$ E. E. will cost 18 times as much $= \frac{90}{105}$ £. $=$ 17 s. 1 d. $2\frac{6}{7}$ qr., *Ans.*

12. $\$11$ for 7 yds. is $\frac{1}{7}$ of $\$\frac{11}{1} = \$\frac{11}{7}$ for 1 yard sold, and $\$7$ for 5 yards is $\frac{1}{5}$ of $\$\frac{7}{1} = \$\frac{7}{5}$ for 1 yd. bought; now, ($\$\frac{11}{7} =$) $\$\frac{55}{35}$ — ($\$\frac{7}{5} =$) $\$\frac{49}{35} = \$\frac{6}{35} =$ gain on 1 yard; then, $\$\frac{200}{1} \div \$\frac{6}{35} = \frac{7000}{6} = 1166\frac{2}{3}$ yds.; and 166 ($\frac{2}{3} =$) $\frac{18}{27} \div 129\frac{17}{27} = 9$ bales, *Ans.*

13. If 6 ft. length of shadow be cast by $5\frac{2}{3} = \frac{17}{3}$ ft. height of staff, then 1 ft. (shadow) will require $\frac{1}{6}$ of $\frac{17}{3}$ ft. $= \frac{17}{18}$ ft. height of staff to cast it, and 153 ft. shadow will require 153 times $\frac{17}{18} = \frac{2601}{18} = 144\frac{1}{2}$ ft., height of steeple, to cast it, *Ans.*

14. If 16 men do the work in $28\frac{1}{3} = \frac{85}{3}$ days, 1 man will require 16 times $\frac{85}{3} = \frac{1360}{3}$ days to do it, and 12 men will do it in $\frac{1}{12}$ of the time, $\frac{1360}{3} \div 12 = \frac{1360}{36} = 37\frac{7}{9}$ days, *Ans.*

15. 240 pieces, at $12\frac{1}{2} = \frac{100}{8}$ s. a piece, will cost $\frac{100}{8}$

× 240 = $\frac{24000}{8}$ s. ÷ (20$\frac{1}{2}$ s. =) $\frac{161}{8}$ s. (the cost of 1 piece in exchange) = $\frac{192000}{1288}$ = 149$\frac{11}{161}$ pieces, *Ans.*

16. 20 yds. × $\frac{3}{4}$ = 15 yds., square measure, of the camlet; 1 yd. length (bocking) × (1$\frac{1}{4}$ =) $\frac{5}{4}$ yd. width = $\frac{5}{4}$ yd. square measure; then 15 yds. ÷ $\frac{5}{4}$ yds. = 12 yds., *Ans.*

17. (1$\frac{1}{4}$ =) $\frac{5}{4}$ yd. width, × (20$\frac{1}{2}$ =) $\frac{41}{2}$ yds. length, = $\frac{205}{8}$ yds. square measure, which ÷ $\frac{3}{4}$ yd. = 34$\frac{1}{6}$ yds., *Ans.*

19. If 5 persons drink (7$\frac{4}{5}$ =) $\frac{39}{5}$ gal. in 1 week, 1 person would drink $\frac{1}{5}$ of $\frac{39}{5}$ = $\frac{39}{25}$ gal. in 1 week; 8 persons would drink 8 times $\frac{39}{25}$ = $\frac{312}{25}$ gal. in 1 week, and in (22$\frac{1}{2}$ =) $\frac{45}{2}$ weeks, they would drink $\frac{312}{25}$ × $\frac{45}{2}$ = $\frac{14040}{50}$ = 280$\frac{4}{5}$ gal., *Ans.*

20. If 9 students spend 10$\frac{7}{9}$ = $\frac{97}{9}$ £. in 18 days, 1 student will spend $\frac{1}{9}$ of $\frac{97}{9}$ £. = $\frac{97}{81}$ £. in 18 days, and $\frac{1}{18}$ of $\frac{97}{81}$ £. = $\frac{97}{1458}$ £. in 1 day; 20 students would spend 20 times $\frac{97}{1458}$ £. = $\frac{1940}{1458}$ £. in 1 day, and in 30 days 30 times $\frac{1940}{1458}$ £. = $\frac{58200}{1458}$ £. = 39 £. 18 s. 4$\frac{20}{81}$ d., *Ans.*

97/81 × 18 = 1458 — 97 × 20 = 1940 × 30 = 58[illegible]
÷ [illegible] 5200 (39 ~~1458 × 20~~ = 26760 (4[illegible]
[illegible] × 12 = 6132 ÷ 1458
÷ 14[illegible]
= 4 [illegible] 360/1458 = 51

## ADDITION AND SUBTRACTION OF DECIMAL FRACTIONS.

### ¶ 70. EXAMPLES FOR PRACTICE.

3. 13‘25 + 8‘4 + 23‘051 + 6 + ‘75 = 51‘451 bushels, *Ans.*
4. 429 + 21‘37 + 355‘003 + 1‘07 + 1‘7 = 808‘143, *Ans.*
5. ‘2 + ‘80 + ‘089 + ‘006 + ‘9 + ‘005 = 2, *Ans.*
6. 329‘7 + 37‘162 + ‘16 = 367‘022, *Ans.*
7. $ 4316 — $ 376‘865 = $ 3939‘135, *Ans.*
8. 35000 — ‘035 = 34999‘965, *Rem.*
13. 29‘3 + 374‘000009 + 97‘253 + 315‘004 + 27 + 100‘4 = 942‘957009, *Ans.*

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## MULTIPLICATION OF DECIMAL FRACTIONS.

### ¶ 71. EXAMPLES FOR PRACTICE.

4. $ 5‘47 × 8‘3 = $ 45‘401, *Ans.*
14. ‘0062 × ‘0008 = 00000496, *Ans.*
15. ($\frac{47}{10}$ =) 4‘7 × ($\frac{1086}{100}$ =) 10‘86 = 51,042, *Ans.*
16. ‘02 × ‘011 = ‘00022, *Ans.*

17. $ 11 × ‘13 = $ 1‘43, *Ans.*
18. $ 2 × ‘375 = $ 75, *Ans.*
19. $ 0‘75 × 24 = $ 18, *Ans.*

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## DIVISION OF DECIMAL FRACTIONS.

### ¶ 73. EXAMPLES FOR PRACTICE.

4. $ 472‘875 ÷ 13 = $ 36‘375, *Ans.*
5. $ 141 ÷ $ ‘75 = 188 bushels, *Ans.*
6. $ 37 × 8 (¶ 29, ex. 10, note,) = 296 lb., *Ans.*
7. $ 8 ÷ 16 (*reference as above*) = 128 oranges, *Ans.*
8. $ 5 ÷ ‘6 = $ 8‘333 +, *Ans.*
9. 2‘0000 ÷ 53‘1 = ‘037 +, *Quot.*
10. ‘0120 ÷ ‘005 = 2‘4, *Ans.*
11. ‘003 ÷ ‘04 = ‘075, *Ans.*
12. 8‘6 ÷ ‘094 = 91‘489 +, *Ans.*
13. 8 ÷ ‘17 = 47 +, *Ans.*

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## REDUCTION OF COMMON OR VULGAR FRACTIONS TO DECIMALS.

### ¶ 74. EXAMPLES FOR PRACTICE.

6. $\frac{478}{962}$ = ‘496 +; $\frac{10}{367}$ = ‘0272 +; $\frac{16}{8600}$ = ‘00186 +.

7. $\frac{4}{9}$ = ‘444 +; $\frac{5}{99}$ = ‘0505 +; $\frac{8}{999}$ = ‘008008 +; $\frac{1}{3}$ = ‘3333 +; $\frac{2}{3}$ = ‘6666 +; $\frac{1}{11}$ = ‘090909 +; $\frac{4}{11}$ = ‘3636 +; $\frac{1}{909}$ = ‘00110011 +.

8. $\frac{1}{8}$ = ‘125; $\frac{3}{8}$ = ‘375; $\frac{5}{8}$ = ‘625; $\frac{1}{5}$ = ‘2; $\frac{2}{5}$ = ‘4; $\frac{3}{5}$ = ‘6; $\frac{4}{5}$ = ‘8; $\frac{1}{20}$ = ‘05; $\frac{1}{25}$ = ‘04; $\frac{3}{75}$ = ‘04.

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## REDUCTION OF DECIMAL FRACTIONS.

### ¶ 75. EXAMPLES FOR PRACTICE.

5. 2$\frac{3}{5}$ qrs. = 2‘6 qrs. ÷ 4 = ‘65 cwt. + 4 cwt. = 4‘65 cwt. ÷ 20 = ‘2325 ton, *Ans.*

6. ‘2325 ton × 20 = 4 cwt. and ‘65 cwt., which × 4 = 2‘60 = 2$\frac{3}{5}$ qr. *Ans.* 4 cwt. 2$\frac{3}{5}$ qr.

7. 3‘52 qts. ÷ 4 = ‘88 gal. + 38 gal. = 38‘88 gal. ÷ 54 = ‘72 ton, *Ans.*

8. *Reverse the last process as before. So in the following examples.*

9. 2 n. ÷ 4 = ‘5 qr. + 1 qr. = 1‘5 qr. ÷ 4 = ‘375 yd. *Ans.*

11. 43 s. ÷ 60 = ‘716 + m. + 6 m. = 6‘716 + m. ÷ 60 = ‘111 + h. + 17h. = 17‘111 + h. ÷ 24 = ‘713 day, *Ans.*

13. 10½ = 10‘5 d. ÷ 12 = ‘875 s. + 21 s. = 21‘875 s. ÷ 28 = ‘78125 guin., *Ans.*

15. 8 oz. ÷ 16 = ‘5 lb. + 7 lb. = 7‘5 lb. ÷ 112 = ‘06696428 + 3 cwt. = 3‘06696428 cwt. ÷ 20 = ‘15334821 ton, *Ans.*

17. 4 r. ÷ 160 = ‘025 acre, *Ans.* *Reversed,* ‘025 acre × 160 = 4 roods.

18. ‘7 lb. × 12 = 8 oz. + ‘4 oz. × 20 = 8 pwt. *Ans.* 8 oz. 8 pwt.

19. 50‘4 s. ÷ 60 = ‘84 m. + 15 m. = 15‘84 m. ÷ 60 = ‘264 h. + 18 h. = 18‘264 h. ÷ 24 = ‘761 day, *Ans.*

20. ‘67 league × 3 = 2 m. and ‘01 m. × 320 = 3 r. and ‘2 r. × 16½ = 3 ft. and ‘3 ft. × 12 = 3‘6 in. *Ans.* 2 m. 3 r. 3 ft. 3‘6 in.

21. 9¼ d. = 9‘25 d. ÷ 12 = ‘7708 s. + 10 s. = 10‘7708 s. ÷ 20 = ‘5385 £., *Ans.*

## ¶ 77. EXAMPLES FOR PRACTICE.

1. 9 s. = ‘45 £., and 7 d. = ‘029 £. *Ans.* ‘479 £.——12 s. = ‘6 £., and ¾ d. = ‘003 £. *Ans.* ‘603 £.

2. *It will be most convenient to decompose the fraction in the following manner;* ‘5 £. = 10 s., and ‘023 £. = 22 (abating 1) = 22 qr. = 5½ d. *Ans.* 10 s. 5½ d. —— ‘694 £. = ‘65 £. = 13 s. + ‘044 £. = 42 (abating 2) = 42 qr. = 10½ d. *Ans.* 13 s. 10½ d.

3. 15 s. = ‘75 £., and 3 d. = ‘012 £.; 8 s. = ‘4 £., and 11½ d. = ‘048 £.; 10 s. = ‘5 £. and 6¼ d. = ‘026 £.; 1 s. = ‘05 £., and 8½ d. = ‘035 £.; ½ d. = ‘002 £.; 2¼ d. = ‘009 £. *Amount,* £. 1‘833.

4. ‘47 £. = 9 s., and ‘020 £. = 4¾ d. *Ans.* 9 s. 4¾ d.

5. ‘75 £. = 15 s., and ‘035 £. = 34 qr. = 8½ d.; ‘35 £. = 7 s., and ‘007 £. = 1¾ d.; ‘9 £. = 18 s., and ‘016 £. = 3¾ d.; ‘7 £. = 14 s., and ‘040 £. = 9½ d.; ‘5 £. = 10 s.; ‘25 £. = 5 s.; ‘05 £. = 1 s., and ‘040 £. = 9½ d.; ‘008 £. = 2 d. *Amount,* 3 £. 12 s. 11 d.

## SUPPLEMENT TO DECIMAL FRACTIONS.

2. 7 ($\frac{3}{10}$ =) ‘3 yds. + 12 ($\frac{5}{8}$ =) ‘625 yds. = 19‘925 yds.; then, 36 ($\frac{5}{8}$ =) ‘625 yds. — 19‘925 yds. = 16‘7 yds., *Ans.*

3. 8‘461 £. + 2‘266 £. + 1‘888 £. + ‘208 £. = 12‘823 £.; 3‘437 £. + 6‘666 £. = 10‘103 £.; then, 12‘823 £. — 10‘103 £. = 2‘720 £., which ÷ ($\frac{1}{40}$ £. =) ‘025 £. = 108$\frac{4}{5}$ lb., *Ans.*

4. 12$\frac{1}{2}$ cts. = $\frac{1}{8}$ of a dollar; therefore 37‘75 ÷ 8 = \$4‘718$\frac{3}{4}$, *Ans.*

5. \$17‘37 × 11‘625 tons = \$201‘92$\frac{5}{8}$, *Ans.*

6. \$201‘92625 ÷ \$11‘625 = \$17‘37, *Ans.*

7. \$9 ÷ ‘45 ton = \$20, *Ans.*

8. \$0‘4 × ‘25 gal. = \$0‘1, *Ans.*

9. 16 lb. ÷ 28 = ‘5714 qr. + 3 qrs. = 3‘5714 qrs. ÷ 4 = ‘8928 cwt. + 7 cwt. = 7‘8928 cwt. × \$9 = \$71‘035 +, *Ans.*

10. 1 qr. = 28 lb. + 14 lb. = 42 lb. ÷ 112 = ‘375 cwt., and 5 cwt. = 5‘375 cwt.; then, \$69‘875 ÷ 5‘375 cwt. = \$13, *Ans.*

13. (12 gal. 3 qts. 1 pt. =) 51‘5 qts. × \$‘28 = \$14‘42, *Ans.*

14. \$100‘125 ÷ (16 yds. 2 qr. 3 na. =) 16‘6875 yds. = \$6, *Ans.*

15. \$‘72 ÷ \$1‘92 = ‘375 bu. × 4 = 1‘5 bu. = 1 peck, 4 qts., *Ans.*

16. \$60‘268 ÷ \$92‘72 = ‘65 ton, × 20 = 13 cwt., *Ans.*

17. \$9‘17 ÷ \$16 = ‘573125 ton, × 20 = 11 cwt. + ‘4625 cwt. × 4 = 1 qr. + ‘85 qr. × 28 = 23 lb. *Ans.* 11 cwt. 1 qr. 23 lb.

18. \$302‘4 × (1 hhd. 15 gal. 3 qts. =) ‘3125 ton, = \$94‘50, *Ans.*

19. \$94‘50 ÷ ‘3125 ton, = \$302‘40, *Ans.*

20. \$1‘80 ÷ (3$\frac{1}{4}$ qts. =) ‘8125 gal. = \$2‘215 +, *Ans.*

22. \$60‘45 ÷ $\frac{5}{8}$ = \$96‘72, *Ans.*

24. \$2 ÷ \$‘8 = \$2‘5, *Ans.*

25. \$2‘5 × \$‘8 = \$2, *Ans.*

26. \$2 ÷ \$2‘5 = ‘8 yd. *Ans.*

27. 19‘25 £. (¶ 76,) ÷ ‘7 ton, = 27‘5 £. = 27 £. 10 s., *Ans.*

30. \$12‘025 ÷ \$18‘50 = ‘65 ton, = 13 cwt., *Ans.*

31. \$6 × (3 qrs. 2 n. =) ‘875 yd. = \$5‘25, *Ans.*

32. \$22‘10 ÷ 65 cwt. = \$‘34 × 20 = \$6‘80, *Ans.*

33. (3 £. 2 s. 3 d. 3$\frac{2}{3}$ qr. =) 3‘1166 £. ÷ (9 oz. 4 pwt. 16 gr. =) 9‘2333 oz. = ‘3375 £. = 6 s. 8 d. 3$\frac{1}{2}$ qr., *Ans.*

34. (3 cwt. 2 qr. 21 lb. =) 3‘6875 cwt. × 9 = 33‘1875 cwt. × (4 £. 9 s. =) 4‘45 £. = 147‘684 £. = 147 £. 13 s. 8$\frac{1}{4}$ d., *Ans.*

35. 1 quarter is 8 bushels. 5‘25 acres ÷ 210 bushels = ‘025 acre (to produce 1 bushel) which × 380 bushels = 9‘5 = 9 acres 2 roods, *Ans.*

36. $1‘25 ÷ $ 20 = ‘0625 oz. = 1 pwt. 6 grs. *Ans.*

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# REDUCTION OF CURRENCIES.

### ¶ 78. EXAMPLES FOR PRACTICE.

4. 75‘75 £. Eng. c. ÷ $\frac{9}{40}$ = $ 336‘666$\frac{2}{3}$; 75‘75 £. Can. c. × 4 = $ 303‘00; 75‘75 £. N. Y. c. ÷ ‘4 = $189‘375; 75‘75 £. N. E. c. ÷ ‘3 = $ 252‘50; 75‘75 £. Penn. c. ÷ $\frac{3}{8}$ = $ 202‘00; 75‘75 £. Georg. c. ÷ $\frac{7}{30}$ = $ 324‘642.

5. 18‘036 £. Eng. c. ÷ $\frac{9}{40}$ = $ 80‘16; —— Can. c. × 4 = $ 72‘144, &c.

6. 0‘019 £. E. c. ÷ $\frac{9}{40}$ = $ ‘084$\frac{4}{9}$; Can. c. × 4 = $ ‘076, &c.

7. 36‘18 £. E. c. ÷ $\frac{9}{40}$ = $160‘80; —— C. c. × 4 = $144‘72, &c.

### ¶ 79. EXAMPLES FOR PRACTICE.

2. $ 250 × $\frac{9}{40}$ = 56 £. 5 s. E. c. —— ÷ 4 = 62 £. 10 s. C. c. —— × ‘3 = 75 £. N. E. c. —— × ‘4 = 100 £. N. Y. c., &c.

3. $ ‘56 × $\frac{9}{40}$ = 2 s. 6$\frac{1}{4}$ d. E. c. —— ÷ 4 = 2 s. 9$\frac{1}{2}$ d. C. c., &c.

4. $ 45‘125 × $\frac{9}{40}$ = 10 £. 3 s. 0$\frac{3}{4}$ d. E. c. —— ÷ 4 = 11 £. 3 s. 7$\frac{1}{2}$ d, C. c., &c.

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# INTEREST.

### ¶ 83. EXAMPLES FOR PRACTICE.

10. $ 8‘50 × ‘107 = $ ‘909, *Ans.*
11. $ 675 × ‘008$\frac{1}{2}$ = $ 5‘737, *Ans.*
12. $ 8673 × ‘001$\frac{2}{3}$ = $14‘455, *Ans.*
13. $ ‘73 × ‘05 = $ ‘036, *Ans.*

14. $96 × '000½ = $'048; or, $'096 ÷ 2 = '048, as before, *Ans.*

15. $73'50 × '000⅓ = $'0245; or, $'0735 ÷ 3 = $'0245, *Ans.*

16. 5 days = ⅓ + ½ of 6 days; therefore $'180 (making no account of the cents,) ÷ 3 and by 2 (uniting the two quotients) = $'150, *Ans.*

19. $520'04 × '06 = $31'2024 (int. for 1 year,) which × 30 = $936'072 (int. for 30 years) to which + ½ the int. for 1 year, making $951'673, *Ans.*

20. The int. for 10 years is $240; $400 × $'016 = $6'40 for 3 mo. 6 days; then, $240 + $6'40 = $246'40, *Ans.*

22. $86 × '06 = $6'40, which × 7 = $36'12; then, $86 + $36'12 = $122'12, *Ans.*

23. 36'477 £. × '06 £. = 2'188 + £. = 2 £. 3 s. 9 d., *Ans.*

24. 36'5 £. × '093⅓ £. = 3'406 + £. = 3 £. 8 s. 1½ d., *Ans.*

25. 18'6 £. × '050½ £. = '939 + £. + 18'6 £. = 19'539 £. = 19 £. 10 s. 9¼ d., *Ans.*

26. 100 £. × '06 £. = 6 £. × 8 = 48 £. + 100 £. = 148 £., *Ans.*

27. 400'5 £. × '09 £. = 36'045 £. + 400'5 £. = 436'545 £. = 436 £. 10 s. 10¾ d. *Ans.*

28. 640'4 £. × '06 £. = 38'424 £. (int. for 1 year) + 640'4 £. = 678'824 = 678 £. 16 s. 5¾ d., amount for 1 year; 38'424 £. × 2½ = 96'060 + 640'4 £. = 736'460 £. = 736 £. 9 s. 2½ d., amount for 2 years and 6 months, &c

**¶ 85.** *Time, rate, and amount given, to find the principal.*

2. $85'12 ÷ $1'12 (amount at given rate and time,) = $76, *Ans.*

3. $99'311 ÷ $1'0565 = $94, *Ans.*

4. $988'00 ÷ $1'04 = $950, *Ans.*

5. $1008'00 ÷ $1'05 = $960, and $1008 — $960 = $48, *Ans.*

Discount. 6. $397'50 ÷ $1'06 = $375, *Ans.*

7. $834 ÷ $1'112 (amount at given rate and time,) = $750, *Ans.*

8. $321'63 ÷ $1'24 = $259'37 (the present worth,) and $321'63 — $259'37 = $62'26, *Ans.*

9. $18 ÷ $1'075 = $16'74 +, *Ans.*

10. ½ of $ 650 = $ 325 (4 mo.) ÷ $ 1'02 = 318'627, and $ 325 (8 mo.) ÷ $1'04 = $ 312'50; then, $ 318'627 + $ 312'50 = $ 631'127, and $ 650 — $ 631'127 = $18'873, *Ans.*

11. $ 56'20 ÷ $1'10 = $ 51'09, *at* 6 *per cent. disc.;* or —— ÷ $1'075 = $52'279, *at* 4½ *per c. disc.;* or —— ÷ $ 1'084 = $ 51'845, *at* 5 *per cent. disc.;* or —— ÷ $1'116 = $ 50'358, *at* 7 *per c. disc.;* or —— ÷ $1'125 = $ 49'955, *at* 7½ *per c. disc.;* or —— ÷ $1'15 = $ 48'869, *at* 9 *per c. disc.*

## ¶ 86. *Time, rate, and interest, to find the principal.*

2. $ 4'52 ÷ $ '08 = $ 56'50, *Ans.*
3. $ 20 ÷ $ '06 = $ 333'333⅓, *Ans.*

## ¶ 87. *Principal, interest, and time, to find the rate per cent.*

2. The interest on $ 468 one year, at 1 per cent., is 468 cents, ÷ 12 = 39 cents, the interest at 1 per cent., 1 month; then, $ 2'34 ÷ $ '39 = 6 per cent., *Ans.*

3. $ 46'80 ÷ $10'40 = 4½ per cent., *Ans.*

## ¶ 88. *Rate per cent. of* LOSS *or* GAIN.

2. $\frac{66}{550}$ = 12 per cent.

3. $\frac{38'50}{550}$ = '07 per cent.; $\frac{24'75}{550}$ = '04½ per cent.; $\frac{2'75}{550}$ = '00½ per cent.

4. $1'0032 — $ '96 = $ '0432 (gain per gal.) × 114 = $ 4'924 + the whole gain; and $\frac{'0432}{'96}$ = 4½ per cent., *Ans.*

5. $ 365 — $ 332'15 = $ 32'85; then, $\frac{32'85}{365}$ = 9 per cent. loss, *Ans.*

6. $\frac{'50}{2}$ = '25 per cent., which is $ 25 on $100, *Ans.*

7. $\frac{'30}{1'20}$ = 25 per cent., *Ans.*

8. 30 × $ 26 = $ 780 — $ 698'33 (first cost and charges,) = $ 81'67; then, $\frac{81'67}{698'33}$ = 11 + per cent., *Ans.*

## ¶ 89. *Principal, rate, and interest, to find the time.*

2. The interest on $ 226'50, one year, is $13'59; therefore $ 31'71 ÷ $ 13'59 = 2'33⅓ = 2 years and 4 months, *Ans.*

3. $ 20 ÷ $ 48 (int. 1 year) = ‘416⅔ = 5 months, *Ans.*
4. $ 28‘242 ÷ $ 8‘69 = 3‘25, very nearly, = 3 years, 3 months, *Ans.*

**¶ 90.** 2. $ 867‘33 × ‘196⅔ (3 y. 3 m. 10 d.) = $ 170‘574 (int.); same principal, × ‘12 (2 y.) = $104‘079 (int.); then, $ 867‘33 + $ 170‘574 + $ 104‘079 = $ 1141‘983 — $ 455‘44 (am't two first payments,) = $ 686‘543 × ‘042½ (8 m. 15 d.) = $ 29‘178 (int.) + $ 686‘543 = $ 715‘721 — $ 518‘68 (3d paym.) = $197‘041 × ‘091⅔ (1 y. 6 m. 10 d.) = $18‘062 (int.) + $197‘041 = $ 215‘103, *Ans.*

## COMPOUND INTEREST.

4. $1, at 6 per ct., by the table, for 4 years, is $1‘2624 +, which × $ 40‘20 = $ 50‘748, &c.

### ¶ 91. EXAMPLES FOR PRACTICE.

10. $175 × ‘184⅙ (3 y. 25 d.) = $ 32‘229 + $ 175 = $ 207‘229, *Ans.*
11. $ 56‘75 × ‘025½ (5 m. 3 d.) = $1‘447 + $ 56‘75 = $ 58‘197, *Ans.*
12. $ 365‘37 × ‘150⅔ (2 y. 6 m. 4 d.) = $ 55‘049 + $ 365‘37 = $ 420‘419 — $ 97‘16 = $ 323‘259 × ‘015⅔ (3 m. 4 d.) = $ 5‘064 + $ 323‘259 = $ 328‘323, *Ans.*
13. $ 317‘92 × ‘131⅓ (2 y. 2 m. 8 d.) = $ 41‘753 + $ 317‘92 = $ 359‘673 — $ 208‘04 = $151‘633 × ‘029½ (5 m. 27 d.) = $ 4‘473 + $151‘633 = $156‘106 — $76 = $ 80‘106 × ‘048½ (9 m. 21 d.) = $ 3‘885 + $ 80‘106 = $ 83‘991, *Ans.*

## SUPPLEMENT TO INTEREST.

### EXERCISES.

1. $ 273‘51 × ‘061⅔ = $ 16‘866 ÷ 6 = $ 2‘811 + $16‘866 = $19‘677, *Ans.*
2. $ 486 × ‘078⅙ = $ 37‘989 ÷ 3 = $ 12‘663 + $ 37‘989 = 50‘652, *Ans.*
3. $ 203‘17 — $ 50 = $153‘17 × ‘139½ (2 y. 3 m. 27 d.) = $ 21‘367 + $ 153‘17 = $ 174‘537, *Ans.*

4. \$870‘05 × ‘239 (3 y. 11 m. 24 d.) = \$207‘941 + \$870‘05 = \$1077‘991 — \$186‘06 = \$891‘931 × ‘172 (2 y. 10 m. 12 d.) = \$153‘412 + \$891‘931 = \$1045‘343, *Ans.*

5. 1 per cent. on \$1600 is \$16, which × $\frac{5}{8}$ = \$10, *Ans.*

6. 1 per cent. on \$5643 is \$56‘43 ÷ 2 = \$28‘215 + \$56‘43 = \$84‘645, at $1\frac{1}{2}$ per cent., &c.

7. \$137‘46 × \$‘625 = \$85‘912, *Ans.*

8. \$800 ÷ 8 = \$100 + \$800 = \$900, *Ans.*

9. \$560‘75 × \$‘93 = \$521‘497, *Ans.*

10. \$422‘40 ÷ \$1‘056 (¶ 85) = \$400, *Ans.*

11. \$426 ÷ \$1‘20167 = \$354‘506, *Ans.*

12. \$300 ÷ \$1‘045 = \$287‘081 — \$250 = \$37,081, gain, *Ans.*

13. $\frac{1}{2}$ of \$3120 = \$1560 ÷ \$1‘015 (3 mo.) = \$1536‘945, and \$1560 ÷ \$1‘03 (6 mo.) = \$1514‘563; then, \$1536‘945 + \$1514‘563 = \$3051‘508, and \$3120 — \$3051‘508 = \$68‘492, *Ans.*

14. \$49‘875 ÷ \$‘105 (¶ 86) = \$475, *Ans.*

15. \$35 ÷ \$‘07 (= int. on \$1, the given time, at 5 per cent.) = \$500, *Ans.*

16. \$15‘50 ÷ \$3‘875 (¶ 87) = 4 per cent., *Ans.*

17. 20 cents — \$‘167 = \$‘033; then, $\frac{‘033}{‘167}$ (¶ 88) = $19\frac{76}{100}$ per cent., which is \$19‘76 on \$100, *Ans.*

18. $\frac{9}{48}$ = $18\frac{36}{100}$ per cent. = 18 £. 15 s. on 100 £., *Ans.*

19. \$1‘10 × 37 = \$40‘70, (cost,) — \$40 = \$‘70, (loss;) $\frac{‘70}{40}$ = ‘01$\frac{3}{4}$ per cent. loss, = \$1‘75 on \$100, *Ans.*

20. 1 £. = 240 d., and 4 s. 6 d. = 54 d.; then, $\frac{54}{240}$ = ‘22$\frac{1}{2}$ per cent. = 22 £. 10 s., *Ans.*

21. \$4‘48 × ‘125 = \$‘56 + \$4‘48 = \$5‘04 per yard, *Ans.*

22. 4 £. × ‘10 = ‘40 £.; then, 4 £. — ‘40 £. = 3‘60 £. = (¶ 75) 3 £. 12 s., *Ans.*

23. 15 s. × ‘175 = 2‘625 s.; then, 15 s. — 2‘625 s. = 12‘375 s. = (¶ 75) 12 s. $4\frac{1}{2}$ d., *Ans.*

24. \$‘92 × 50 = \$46, (cost,) × ‘10 (per cent.) = \$4‘60 + \$46 = \$50‘60 ÷ 40 gal. = \$1‘26$\frac{1}{2}$ per gal., *Ans.*

25. \$950 + \$145 + \$25 = \$1120 × ‘20 (per cent.) = \$224 + \$1120 = \$1344 ÷ (10 tons =) 22400 lb. = \$‘06 per lb., *Ans*

# EQUATION OF PAYMENTS.

**¶ 92.** 6. $\$\,\overline{50\times 2}+\$\,\overline{100\times 5}+\$\,\overline{150\times 8}=\$\,1800 \div \$\,300=6$ months, *Ans.*

7. $\$\,\overline{136\times 10}+\$\,\overline{96\times 7}+\$\,\overline{260\times 4}=\$\,3072\div\$\,492=6$ m. (¶ 75,) 7 days, *Ans.*

8. $\$\,\overline{200\times 4}+\$\,\overline{200\times 8}=\$\,2400\div\$\,600=4$ m., *Ans.*

9. $\$\,\overline{100\times 3}+\$\,\overline{75\times 4}+\$\,\overline{124\times 6}\div\$300=4\frac{1}{2}$ m., *Ans.*

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# PROPORTION.

## ¶ 95. EXAMPLES FOR PRACTICE.

5. As 6 horses : 20 horses : : 21 bush. : ——
$20\times 21=420$, which $\div\, 6=70$ bush., *Ans.*

6. *Reversed.* As 20 h. : 6 h. : : 70 b. : ——
$6\times 70=420$, which $\div\, 20=21$ bush., *Ans.*

7. As 365 m. : 500 m. : : 75 bar. : ——
$500\times 75=37500$, which $\div\, 365=102$ $(\frac{270}{365}=)$ $\frac{54}{73}$ bar., *Ans.*

8. *Reversed.* As 500 m. : 365 m. : : $102\frac{54}{73}$ : ——
$102\frac{54}{73}=\frac{7500}{73}\times 365=\frac{2737500}{73}$, which $\div\, 500=\frac{5475}{73}=$ 75 bar., *Ans.*

9. As (5 s. 4d. =) 64 d. : (10 £. 12 s. =) 2544 d. : : 1 oz. : ——
$1\times 2544=2544$, which $\div\, 64=39$ oz. (and $\frac{48}{64}$ oz. =) 15 pwt., *Ans.*

10. As (13° 10′ 35″ =) 47435″ : (360° =) 1296000″ : : 1 day : ——
$1\times 1296000=1296000$, which $\div\, 47435=27$ days, 7 h. 43 m. 6 s. +, *Ans.*

11. As \$ 145 : \$ 378 : : \$ 12‘63, taxes : \$ 32‘925, *Ans.*

12. As \$ ‘75 : \$ 6 : : 7 lb. : 56 lb., *Ans.*

13. 8 lb. of sugar will cost \$ 1, = the cost of 5 lb. of coffee; therefore, As 5 lb. cof. : 100 lb. cof. : : \$ 1 : \$ 20, *Ans.*

14. \$ 100 : \$ 357‘82 : : \$ 6 : \$ 21‘469, *Ans.*

15. As 15 eightieths : 80 eightieths : : 1 m. : $5\frac{1}{3}$ minutes, *Ans.*

16. As 10 : 30 : : 3 bu. : 9 bu., *Ans.*

17. As 6 ft. : 153 ft. : : (5 ft. 8 in. =) 68 in. : 1734 in. = $144\frac{1}{2}$ ft., *Ans.*

19. As 3 £. ster. : 1000 £. st. :: 4 £. Mass. : 1333‘333 £. = 1333 £. 6 s. 8 d. Mass., *Ans.*

20. As 1333‘333 £. Mass. : 4 £. Mass. :: 1000 £. ster. : 3 £. ster., *Ans.*

21. As 1000 £. ster. : 3 £. ster. :: 1333‘333 £. Mass. : 4 £. Mass., *Ans.*

22. As 4 £. Mass. : 1333‘333 £. Mass. :: 3 £. ster. : 1000 £. ster., *Ans.*

23. 105 × 200 = 21000 lb. spoiled bread; 2000 × 14 = 28000 oz. = 1750 lb. × (12 weeks =) 84 days = 147000 lb., whole weight; then, 147000 lb. — 21000 lb. = 126000 lb., left to subsist on.

As 147000 lb. : 126000 lb. :: 14 oz. : 12 oz., *Ans.*

24. 2000 men, 12 oz. per day each, 12 weeks = 126000 lb., which is $\frac{6}{7}$ of the whole weight; then,

As 6 : 7 :: 126000 lb. : 147000 lb., the whole weight, which ÷ 7 = 21000 lb., spoiled.

25. 2000 men, 12 oz. per day each, 12 weeks = 126000 lb. to subsist on; then,

As 12 oz. : 14 oz. :: 126000 lb. : 147000 lb., the whole weight.

26. Whole weight, spoiled or lost, and left to subsist on, found as in example 23; then,

As 126000 lb. : 147000 lb. :: 12 oz. : 14 oz. per day, had none been lost.

27. Less time, more workmen; the proportion, therefore, is *inverse.* 120 workmen, being of the same kind with the answer sought, must be the third term; and as, from the nature of the question, the answer sought must be greater, therefore make the greater of the two remaining numbers (8 months) the second term, &c.

As 2 months : 8 months :: 120 men : 480 men, *Ans.*

28. Less time, more pipes will be required; *inverse.*

As 24 min. : (10 h. =) 600 m. :: 1 pipe : 25 pipes, *Ans.*

29. More men, less time will the provisions serve; *inverse.*

As 1600 men : 1200 men :: 9 m. : $6\frac{3}{4}$ months, *Ans.*

30. Greater in breadth, less in length to make an acre; *inverse.* As 25 l. : 40 l. :: 4 b. : $6\frac{2}{5}$ b., *Ans.*

31. Shorter the days, more days required; *inverse.*

As 10 h. : 12 h. :: 15 d. : 18 days, *Ans.*

32. *Inverse.* As 21 cows : 6 cows :: 91 days : 26 days, *Ans.*

33. *Inverse.* As $806 : $292 : 6 months : 2 months, (¶ 75,) 5 + days, *Ans.*

34. *Inverse.* As ($\frac{1}{5}$ of 11 d. =) 2‘2 d. : 11 d. :: 30 m. : 150 m., required to do the same work in $\frac{1}{5}$ of the time. To do 4 times the work, will require 4 times the men, and 150 × 4 = 600 men, *Ans.*

35. As $\frac{11}{13}$ lb. : $\frac{32}{43}$ lb. :: $\frac{7}{15}$ s. : ——

$\frac{7}{15}$ of $\frac{32}{43} = \frac{224}{645}$, which $\div \frac{11}{13}$ ($\frac{13}{11}$ of $\frac{224}{645}$) $= \frac{2912}{7095}$ s. (¶ 63,) $= 4$ d. $3\frac{4971}{7095}$ q., *Ans.*

36. As 7 lb. : 12 lb. :: \$ $\frac{3}{4}$ : ——

$\frac{3}{4} \times 12 = \frac{36}{4}$, which $\div\, 7 = \frac{36}{28} =$ \$ $1\frac{2}{7}$, *Ans.*

37. As ($6\frac{1}{2}$ =) $\frac{13}{2}$ yd. : ($9\frac{1}{4}$ =) $\frac{37}{4}$ yd. :: \$ 3 : ——

$3 \times \frac{37}{4} = \frac{111}{4}$, which $\div \frac{13}{2}$ ($\frac{2}{13}$ of $\frac{111}{4}$) $= \frac{222}{52} =$ \$ 4‘269+, *Ans.*

38. As 2 oz. : ‘75 oz. :: \$ 2‘24 : ——

2‘24 × ‘75 = 1‘6800, which ÷ 2 = \$ ‘84, *Ans.*

39. As $\frac{5}{7}$ oz. : 1 oz. :: \$ $\frac{11}{12}$ : ——

$\frac{11}{12} \times 1 = \frac{11}{12}$, which $\div \frac{5}{7}$ ($\frac{7}{5}$ of $\frac{11}{12}$) $= \frac{77}{60} =$ \$ 1‘283, *Ans.*

40. ($\frac{1}{3}$ =) $\frac{2}{6} - \frac{1}{6} = \frac{1}{6}$ lb.; and (14 lb. =) $\frac{70}{5}$ — ($\frac{1}{5}$ of $\frac{2}{1}$ =) $\frac{2}{5} = \frac{68}{5}$ lb.; then,

As $\frac{1}{6}$ lb. : $\frac{68}{5}$ lb. :: ($13\frac{1}{5}$ =) $\frac{66}{5}$ d. : ——

$\frac{66}{5} \times \frac{68}{5} = \frac{4488}{25}$, which $\div \frac{1}{6}$ ($\frac{6}{1}$ of $\frac{4488}{25}$) $= \frac{26928}{25}$ d. = 4 £. 9 s. $9\frac{3}{25}$ d. *Ans.*

41. As $\frac{3}{5}$ yd. : ($40\frac{1}{2}$ =) $\frac{81}{2}$ yd. :: \$ $\frac{7}{8}$ : ——

$\frac{7}{8} \times \frac{81}{2} = \frac{567}{16}$, which $\div \frac{3}{5}$ ($\frac{5}{3}$ of $\frac{567}{16}$) $= \frac{2835}{48} =$ \$ 59‘062+, *Ans.*

42. As $\frac{7}{16}$ ship : $\frac{3}{32}$ ship :: \$ 251 : ——

$251 \times \frac{3}{32} = \frac{753}{32}$, which $\div \frac{7}{16}$ ($\frac{16}{7}$ of $\frac{753}{32}$) $= \frac{12048}{224} =$ \$ 53‘785+, *Ans.*

43. As (1 cwt. =) 112 lb. : ($9\frac{2}{3}$ =) $\frac{29}{3}$ lb. :: ($3\frac{5}{8}$ £. =). $\frac{29}{8}$ £. : ——

$\frac{29}{8}$ £. × $\frac{29}{3} = \frac{841}{24}$, which $\div\, 112 = \frac{841}{2688}$ £. = 6 s. $3\frac{5}{56}$ d., *Ans.*

44. As ($\frac{2}{3}$ of $\frac{4}{5}$ =) $\frac{8}{15}$ ves. : 1 ves. :: \$ 957 : ——

957 × 1 = 957, which $\div \frac{8}{15}$ (¶ 55) = \$ 1794‘375, *Ans.*

45. $\frac{9}{15}$ E. E. × 5 $= \frac{45}{15}$ qr., which $\div\, 4 = \frac{45}{60} = \frac{3}{4}$ yd.; then,
As $\frac{5}{8}$ yd. : $\frac{3}{4}$ yd. :: $\frac{5}{7}$ £. : $\frac{120}{140}$ £. = 17 s. 1 d. $2\frac{6}{7}$ q., *Ans.*

46. First find what he gained in selling 1 yd.; then it will be easily ascertained how many yards he must sell to gain \$ 200.

As 7 yds. : 5 yds. :: \$ 11 : \$ $7\frac{6}{7}$ (what 5 yds. sold for) — \$ 7 (cost,) = \$ $\frac{6}{7}$, gained in selling 5 yds., which ÷ 5 = \$ $\frac{6}{35}$, gained in selling 1 yd.; then \$ 200 ÷ \$ $\frac{6}{35} = \frac{7000}{6}$ yds. sold, which ÷ ($129\frac{17}{27}$ yds. contained in 1 bale =) $\frac{3500}{27}$ yds. ($\frac{27}{3500}$ of $\frac{7000}{6}$) = $\frac{189000}{21000}$ = 9 bales, *Ans.*

47. As 6 bar. : 178 bar. :: \$33 : \$979, *Ans.*

48. As 3‘17 cwt. : (1 ton =) 20 cwt. :: \$2‘25 : \$14‘195+, *Ans.*

49. As 2‘5 lb. : 185 lbs. :: \$‘75 : \$55‘50, *Ans.*

50. As 1 hhd. : ‘15 hhd. :: \$2‘39 : \$‘3585, *Ans.*

51. As ‘15 hhd. : 1 hhd. :: \$‘3585 : \$2‘39, *Ans.*

## COMPOUND PROPORTION.

### ¶ 97. EXAMPLES FOR PRACTICE.

1. 16 days, being of the same kind as the answer required, must be made the 3d term; then

$$\left.\begin{array}{lrl} \text{More men, less days,} & 24 : & 6 \\ \text{More length, more days,} & 20 : & 200 \\ \text{More height, more days,} & 6 : & 8 \\ \text{More thickness, more days,} & 4 : & 6 \end{array}\right\} :: 16 \text{ days} : \text{——}$$

$(6 \times 200 \times 8 \times 6 =)\ 57600 \times 16 = 921600$, which ÷ $(24 \times 20 \times 6 \times 4 =)\ 11520 = 80$ days, *Ans.*

2. 16 £. is the 3d term, being of the kind sought. 9 hhds., of 12 cwt. each, = 108 cwt., and 50 tierces, of $2\frac{1}{2}$ cwt. each, = 125 cwt.; then

$$\left.\begin{array}{lrl} \text{More cwt., more pay,} & 108 : & 125 \\ \text{More leagues, more pay,} & 20 : & 100 \end{array}\right\} :: 16\,£. : \text{——}$$

$(125 \times 100 =)\ 12500 \times 16 = 200000 \div (108 \times 20 =)\ 2160$ = 92 £. 11 s. $10\frac{2}{9}$ d., *Ans.*

3. $\left.\begin{array}{lrl} \text{More men, more bread,} & 7 : & 21 \\ \text{Less days, less bread,} & 14 : & 3 \end{array}\right\} :: 56 \text{ lb.} : 36 \text{ lb.}$, *Ans.*

4. $\left.\begin{array}{lrl} \text{More pay, more men,} & \$11‘04 : & \$103‘04 \\ \text{More days, less men,} & 16 : & 3 \end{array}\right\} :: \overset{\text{men,}}{4} : \overset{\text{men,}}{7}$, *Ans.*

5. $\left.\begin{array}{l} 4\frac{3}{4}\text{ d.} = \frac{19}{4}\text{ d., and 1 s. 2 d.} = 14\text{ d.} \\ 4\text{ s. 2 d.} = 50\text{ d., and 5 s. 6 d.} = 66\text{ d.} \end{array}\right\} \begin{array}{l} 7\text{ oz. 5 pwt.} \\ = 145\text{ pwt.} \end{array}$

$$\left.\begin{array}{lrl} \text{More money expended, more bread,} & \frac{19}{4}\text{ d.} : & 14\text{ d.} \\ \text{More paid per bushel, less bread,} & 66\text{ d.} : & 50\text{ d.} \end{array}\right\} :: \overset{\text{pwt.}}{145} : \text{—}$$

$(14 \times 50 =)\ 700 \times 145 = 101500 \div (\frac{19}{4} \times 66 = \frac{1254}{4} =)\ \frac{627}{2}$ $= 323\frac{479}{627}$ pwt. = 1 lb. 4 oz. $3\frac{479}{627}$ pwt., *Ans.*

6. $\left.\begin{array}{lrcr}\text{Prin.} & \$100 & : & \$400 \\ \text{Time, } 12\text{ mo.} & & : & 9\text{ mo.}\end{array}\right\} :: \$6\text{ int.} : \$18\text{ int.},$ *Ans.*

7. $\left.\begin{array}{lrcr}\text{Prin.} & \$400 & : & \$100 \\ \text{Int.} & \$6 & : & \$18\end{array}\right\} :: 12\text{ mo.} : 9\text{ mo.},$ *Ans.*

8. $\left.\begin{array}{lrcr}\text{Prin.} & \$400 & : & \$100 \\ \text{Time,} & 9\text{ mo.} & : & 12\text{ mo.}\end{array}\right\} :: \$18\text{ int.} : \$6\text{ int.},$ *Ans.*

9. $\left.\begin{array}{lrcr}\text{Time,} & 9\text{ mo.} & : & 12\text{ mo.} \\ \text{Int.} & \$6 & : & \$18\end{array}\right\} :: \overset{\text{prin.}}{\$100} : \overset{\text{prin.}}{\$400},$ *Ans.*

10. $\left.\begin{array}{lrcr}\text{Prin.} & \$75 & : & \$100 \\ \text{Time,} & 8\text{ mo.} & : & 12\text{ mo.}\end{array}\right\} :: \$4\text{ int.} : \$8\text{ per cent.},$ *Ans.*

11. $\left.\begin{array}{rcr}3\text{ men} & : & 20\text{ men} \\ (19\frac{1}{2}=)\frac{39}{2}\text{ days} & : & (100\frac{1}{4}=)\frac{401}{4}\text{days}\end{array}\right\} :: (8\frac{9}{10}=)\frac{89}{10}£ : \text{——}$
$(\frac{401}{4}\times 20=)\frac{8020}{4}\times\frac{89}{10}=\frac{713780}{40}$, which $\div$ $(\frac{39}{2}\times 3=)$
$\frac{117}{2}$ $(\frac{2}{117}$ of $\frac{713780}{40})=\frac{1427560}{4680}=305£.$ 0 s. 8 d., *Ans.*

---

## SUPPLEMENT TO THE SINGLE RULE OF THREE.

### EXERCISES.

1. 76 yds. × 4 = 304 qrs. ÷ 5 = 60‘8 E. E.; then,
As 60‘8 E. E. : 1 E. E. :: $113‘17 : $1‘861, *Ans.*

2. 4 pieces × 24 = 96 E. E. × 5 = 480 qrs. ÷ 4 = 120 yds.; then,
As 120 yds. : 1 yd. :: $96 : $‘80, *Ans.*

3. More time, less allowance; therefore,
As 9‘5 mo. : 8 mo. :: 15 oz. : $12\frac{12}{19}$ oz., *Ans.*

4. As $2‘50 : $3‘75 :: 360 acres : 540 acres, *Ans.*

5. Less the price, more the quantity; therefore,
As (17 s. 4 d. =) 208 d. : (19 s. =) 228 d. :: 185 qrs. : $202\frac{41}{52}$ qrs., *Ans.*

6. As ($\frac{3}{4}$ of $\frac{3}{5}=$) $\frac{9}{20}$ mine, : 1 mine, :: 171 £. : 380 £., *Ans.*

7. $\frac{5}{9}$ of $\frac{4}{1}$ of $\frac{63}{1}$ (¶ 64) = $\frac{1260}{9}$ gal.; then,
As $\frac{5}{8}$ gal. : $\frac{1260}{9}$ gal. :: $\$\frac{5}{8}$ : ——
$\frac{1260}{9}\times\frac{5}{8}=\frac{6300}{72}$, which $\div\frac{5}{8}$ $(\frac{8}{5}$ of $\frac{6300}{72})=\frac{50400}{360}=\$140$; or, the first and third terms being the same number, they may be dropped, and the second term taken to express the answer, thus, $\frac{1260}{9}=\$140$, as before.

8. As (1 cwt.=) 112 lb. : ($3\frac{1}{3}$=) $\frac{10}{3}$ lb. : : ($1\frac{1}{2}$=) $\frac{3}{2}$ £. : ——
$\frac{10}{3} \times \frac{3}{2} = \frac{30}{6}$, which $\div 112 = \frac{30}{672}$ £. (of $\frac{20}{1}$ of $\frac{12}{1}$) =
$\frac{7200}{672}$ d. = $10\frac{5}{7}$ d., *Ans.*

9. As 20 miles : 36 miles : : ($4\frac{1}{2}$ cwt. =) 504 lb. : $907\frac{1}{5}$ lb., *Ans.*

10. As (13° 10′ 35″ =) 47435″ : (360° =) 1296000″ : : 1 day : 27 d. 7 h. 43 m., *Ans.*

11. As $\left\{\begin{array}{l} 9\text{ per.} : 14\text{ per.} \\ 5\text{ mo.} : \ 8\text{ mo.} \end{array}\right\}$ : : \$ 450 : \$ 1120, *Ans.*

---

# FELLOWSHIP.

¶ 98. 5. \$ 175 + \$ 200 + \$ 500 = \$ 875; then, As
\$ 875 : \$ 175 : : \$ 250 : \$ 50, A's loss.
\$ 875 : \$ 200 : : \$ 250 : \$ 57‘$142\frac{6}{7}$, B's loss.
\$ 875 : \$ 500 : : \$ 250 : \$ 142‘$857\frac{1}{7}$, C's loss.

6. 1 + 2 + 3 = 6; then, As
6 : 1 : : \$ 600 : \$ 100.
6 : 2 : : \$ 600 : \$ 200.
6 : 3 : : \$ 600 : \$ 300.

7. As 500 hhd. : 350 hhd. : : 100 hhd. : 70 hhd., A's loss.
500 hhd. : 150 hhd. : : 100 hhd. : 30 hhd., B's loss.

8. As 3 : 2 : : \$ 45 : \$ 30, B's stock.

9. 1 + 2 = 3; then,
As 3 : 1 : : \$ 400 : \$ 133‘$333\frac{1}{3}$, A's stock.
3 : 2 : : \$ 400 : \$ 266‘$666\frac{2}{3}$, B's stock.

10. \$ 780 + \$ 460 + \$ 760 = \$ 2000; then,
As \$ 2000 : \$ 780 : : \$ 600 : \$ 234, A's dividend.
\$ 2000 : \$ 460 : : \$ 600 : \$ 138, B's dividend.
\$ 2000 : \$ 760 : : \$ 600 : \$ 228, C's dividend.

11. 2 + 5 = 7; then,
As 7 : 5 : : \$ 164 : \$ 117‘$142\frac{6}{7}$, A's gain.
7 : 2 : : \$ 164 : \$ 46‘$857\frac{1}{7}$, B's gain.
And \$ 117‘$142\frac{6}{7}$ — \$ 46‘$857\frac{1}{7}$ = \$ 70‘$285\frac{5}{7}$ for A's trouble.

12. \$ 12000 × ‘15 = \$ 1800, annual profit; then,
As 100 shares : 1 share : : \$ 1800 : \$ 18, profit on each share, which × 2 = \$ 36, profit on 2 shares, &c.

13. As 100 shares : 1 share : : \$ 340 : \$ 3‘40, tax on each share; and \$ 3‘40 × 2 = \$ 6‘80, tax on 2 shares, &c.

14. As \$ 37000 : \$ 1 : : \$1850 : \$‘05, tax on \$ 1; and \$ 1780 × \$ ‘05 = \$89, tax on \$ 1780.

**¶ 99.** 16, 17. Carried out by the table, in all respects as in the 15th example.

18. 24 cows + 16 cows = 40 cows; then,

$$\text{As}\begin{cases}40 \text{ cows} : 24 \text{ cows} :: \$10 : \$6, \text{ A's part.}\\ 40 \text{ cows} : 16 \text{ cows} :: \$10 : \$4, \text{ B's part.}\end{cases}$$

**¶ 100.** 20.

$$\left.\begin{array}{l}\left.\begin{array}{l}\text{A, }\$100\times6\text{ mo.}=600\\ -\$150\times6\text{ mo.}=900\end{array}\right\}=1500\\ \left.\begin{array}{l}\text{B, }\$200\times4\text{ mo.}=800\\ -\$120\times8\text{ mo.}=960\end{array}\right\}=1760\end{array}\right\}=3260.$$

$$\text{As}\begin{cases}3260 : 1500 :: \$95 : \$43‘711\frac{107}{163}, \text{ A's share.}\\ 3260 : 1760 :: \$95 : \$51‘288\frac{56}{163}, \text{ B's share.}\end{cases}$$

21.

$$\left.\begin{array}{l}\text{A, }\$500\times12\text{ mo.}=6000\\ \text{B, }\$600\times10\text{ mo.}=6000\\ \text{C, }\$800\times6\text{ mo.}=4800\end{array}\right\}=16800.$$

$$\text{As}\begin{cases}16800 : 6000 :: \$700 : \$250, \text{ A's share.}\\ 16800 : 6000 :: \$700 : \$250, \text{ B's share.}\\ 16800 : 4800 :: \$700 : \$200, \text{ C's share.}\end{cases}$$

---

# ALLIGATION.

**¶ 101.** 2. 5 lb., at 10 cts., cost 50 cts.
8 .......... 12 ............ 96 ....
20 .......... 14 ............ 280 ....
33 lbs. 426 cts.

$\frac{426}{33}=12\frac{10}{11}$ cts., *Ans.*

3. 3 oz. 20 car. = 60 car.
5 ...... 22 ...... = 110 .....
8 oz. 170 car.

$\frac{170}{8}=21\frac{1}{4}$ car., *Ans.*

4. 40 gal., at 42 cts., cost 1680 cts.
6 ............ 0 ............... 0 .....
46 gal. 1680 cts.

$\frac{1680}{46}=36\frac{12}{23}$ cts., *Ans.*

5. 5 h. at 64° = 320°
4 h. .. 70° = 280°
2 h. .. 75° = 150°
3 h. .. 73° = 219°
14 h. 969°

$\frac{969}{14}=69\frac{3}{14}$ deg., *Ans.*

## ¶ 102. *Mean price or rate, &c.*

5. 10 cts. { 7 cts. — 2 lb. = 2 lb. of the 1st kind.
9 cts. — 2 lb. = 2 lb. ........... 2d kind.
12 cts. — 3 lb. + 1 lb. = 4 lb. 3d kind.

6. The proportions of the 1st and 2d kinds are alike. To find what will be the proportion of the 3d kind, using
1 lb. of 1st kind, As 2 lb. : 1 lb. : : 4 lb. : 2 lb. of 3d kind.
4 lb. .................. As 2 lb. : 4 lb. : : 4 lb. : 8 lb. ..................
6 lb. .................. As 2 lb. : 6 lb. : : 4 lb. : 12 lb. ..................
10 lb. .................. As 2 lb. : 10 lb. : : 4 lb. : 20 lb. ..................
20 lb. .................. As 2 lb. : 20 lb. : : 4 lb. : 40 lb. ..................

7. 24 d. { 16 d. — 8 lb. = 8 lb. } Proportions
20 d. — 8 lb. = 8 lb. } alike.
32 d. — 8 lb. + 4 lb. = 12 lb.
As 8 lb. : 5 lb. : : 12 lb. : $7\frac{1}{2}$ lb. of the 3d kind, to be taken with 5 lb. of the 1st and 2d kinds.

8. 70 cts. { 0 — 10 gal., proportional quantity of water.
80 — 70 gal., proportional quantity of rum.
As 70 gal. rum : 60 gal. rum : : 10 gal. wat. : $8\frac{4}{7}$ gal. wat., *A.*

9. 84 cts. { $ 1'50 — 34 bu. proportional quant. wheat.
$ 1'16 — 9 bu. .................... .......... rye.
$ 0'75 — 32 bu. .................... .......... corn.
$ 0'50 — 66 bu. .................... .......... barley.
As 34 bu. wh. : 4 bu. wh. : : 9 bu. rye : $1\frac{1}{17}$ bu. rye, }
As 34 bu. wh. : 4 bu. wh. : : 32 bu. cor. : $3\frac{13}{17}$ bu. cor. } *Ans.*
As 34 bu. wh. : 4 bu. wh. : : 66 bu. bar. : $7\frac{13}{17}$ bu. bar. }

10. 22. { 17 — 2 = 2 parts of the 1st kind, }
19 — 2 = 2 parts of the 2d kind, } *Ans*
21 — 2 = 2 parts of the 3d kind, }
24 — 5 + 3 + 1 = 9 parts of the 4th kind, }

11. The proportions of the 3 first kinds are alike. As 2 oz. : 1 oz. : : 9 oz. : $4\frac{1}{2}$ oz. (of the 4th kind) + 1 + 1 + 1 = $7\frac{1}{2}$ oz. of the mixture, *Ans.*

12. $7\frac{1}{2}$ oz. (compound in the last ex.) = $\frac{15}{2}$ oz.
15 oz. mixt. { As $\frac{15}{2}$ oz. : 15 oz. : : 1 oz. : 2 oz. 3 first kinds,
As $\frac{15}{2}$ oz. : 15 oz. : : ($4\frac{1}{2}$=) $\frac{9}{2}$ oz. : 9 oz. 4th k. } *Ans.*
30 oz. mixt. { As $\frac{15}{2}$ oz. : 30 oz. : : 1 oz. : 4 oz. 3 first kinds,
As $\frac{15}{2}$ oz. : 30 oz. : : $9\frac{1}{2}$ oz. : 18 oz. 4th kind,

14. $ '92 { 0 — 28 } 120, sum of the pro-
$ 1'20 — 92 } portional quantities.
As { 120 : 75 : : 28 : $17\frac{1}{2}$ gals. water, } *Ans.*
120 : 75 : : 92 : $57\frac{1}{2}$ gals. brandy, }

15. $$8\text{ d.}\left\{\begin{array}{l} 4\text{ d.} \\ 6\text{ d.} \\ 9\text{ d.} \\ 11\text{ d.} \end{array}\right. \begin{array}{c} 3 \\ 1 \\ 2 \\ 4 \end{array}\left\}\begin{array}{l} \text{10, sum of the pro-} \\ \text{portional quantities.} \end{array}\right.$$

$$\text{As}\left\{\begin{array}{l} 10 : 240 :: 3 : 72\text{ lb. at } 4\text{ d.} \\ 10 : 240 :: 1 : 24\text{ lb. at } 6\text{ d.} \\ 10 : 240 :: 2 : 48\text{ lb. at } 9\text{ d.} \\ 10 : 240 :: 4 : 96\text{ lb. at } 11\text{ d.} \end{array}\right\}\textit{Ans.}$$

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# DUODECIMALS.

## ¶ 103. EXAMPLES FOR PRACTICE.

3. 12 ft. 8′ × 1 ft. 1′ = 13 ft. 8′ 8″, which × 15 = 205 ft. 10′, *Ans.*

4.

| | ft. | ′ | ″ | ‴ | ⁗ |
|---|---|---|---|---|---|
| | 371 ft. | 2′ | 6″ | ‴ | ⁗ |
| | 181 | 1 | 9 | | |
| 371 ft. × 181 ft. = | 67151 | | | | |
| 2′ × 181 ft. = | 30 | 2 | | | |
| 6″ × 181 ft. = | 7 | 6 | 6 | | |
| 371 ft. × 1′ = | 30 | 11 | | | |
| 2′ × 1′ = | | | 2 | | |
| 6″ × 1′ = | | | | 6 | |
| 371 ft. × 9″ = | 23 | 2 | 3 | | |
| 2′ × 9″ = | | | 1 | 6 | |
| 6″ × 9″ = | | | | 4 | 6 |
| | 67242 | 10 | 1 | 4 | 6 *Ans.* |

5. 72 ft. × 8 ft. = 576 ft.; 4′ × 8 ft. = 2 ft. 8′; 72 ft. × 2′ = 12 ft.; 4′ × 2′ = 8″, which amounts added together = 590 ft. 8′ 8″ ÷ 9 = 65 sq. yds. 5 ft. 8′ 8″, *Ans.*

6. 47 ft. × 7 ft. = 329 ft.; 3′ × 7 ft. = 1 ft. 9′; 47 ft. × 6′ = 23 ft. 6′; and 3′ × 6′ = 1′ 6″, which amounts collected = 354 ft. 4′ 6″ ÷ 9 = 39 yds. 3 ft. 4′ 6″, *Ans.*

7. 8 ft. × 4 ft. = 32 ft., and 32 ft. × 3 ft. = 96 ft.; 32 ft. × 6′ = 16 ft.; then 96 ft. + 16 ft. = 112 ft., and 112 ft. ÷ 16 = 7 cord ft., *Ans.*

8. 176 ft. × 3 ft. 9′ = 660 ft., and 660 ft. × 4 ft. 3′ = 2805 ft., which ÷ 128 = 21 cords + 117 ft. ÷ 16 = $7\frac{5}{16}$ cord ft., *Ans.*

9. 7 × 3 = 21 ft.; 21 ft. × 3 = 63 ft.; 21 × 4′ = 7 ft.;

then 63 ft. + 7 ft. = 70 ft., which ÷ 16 = $4\frac{3}{8}$ cord ft. × \$'40 = \$1'75, *Ans.*

10. \$1'92 a cord is \$'24 a cord foot; 10 ft. × 3 ft. 9′ = 37 ft. 6′, which × 4 ft. 8′ = 175 ft. — 128 ft. (1 cord) = 47 ft., which ÷ 16 = $2\frac{15}{16}$ cord ft., at \$'24 a foot, ($2\frac{15}{16}$ × 24,) is \$'$70\frac{1}{2}$; then \$1'92 + \$'$70\frac{1}{2}$ = \$2'$62\frac{1}{2}$, *Ans.*

11. 4'5 ft. × 2'6 ft. = 11'7 ft. × \$'75 = \$8'775, *Ans.*

12. 7'5 ft. × 3'6 ft. = 27 ft., which × 4'8 ft. = 129'6 = 1 cord, $1\frac{1}{2}$ ft., *Ans.*

13. 10 ft. × 3'4 ft. = 34 ft., which × 3'5 ft. = 119 ft., which ÷ 16 = $7\frac{7}{16}$ cord ft., *Ans.*

---

# EXTRACTION OF THE SQUARE ROOT.

## ¶ 107. EXAMPLES FOR PRACTICE.

4. 99̇80̇01̇ ( 999, *Ans.*
81
189 ) 1880
1701
1989 ) 17901
17901

5. 2̇34̇'09̇ ( 15'3, *Ans*
1
25 ) 134
125
303 ) 909
909

6. 9̇64̇'51̇92̇36̇02̇41̇ ( 31'05671, *Ans.*
9
61 ) 64
61
6205 ) 35192
31025
62106 ) 416736
372636
621127 ) 4410002
4347889
6211341 ) 6211341
6211341

7. '00̇12̇96̇ ( '036, *Ans.*
9
66 ) 396
396

8. '29̇16̇ ( '54, *Ans.*
25
104 ) 416
416

9. $3\dot{6}3\dot{7}2\dot{9}6\dot{1}$ ( 6031, *Ans.*
36
1203 ) 3729
3609
12061 ) 12061
12061

10. $\dot{1}6\dot{4}$ ( 12‘8 +, *Ans.*
1
22 ) 064
44
248 ) 2000
1984
16

**¶ 108.** 11. $\dot{3}$ ( 1‘73 +, *Ans.*
1
27 ) 200
189
343 ) 1100
1029
71

12. $1\dot{0}$ ( 3‘16 +, *Ans.*
9
61 ) 100
61
626 ) 3900
3756
144

13. $\dot{1}8\dot{4}$‘$2\dot{0}$ ( 13‘57 +, *Ans.*
1
23 ) 84
69
265 ) 1520
1325
2707 ) 19500
18949
551

14. $\dot{4}$ Num. ( 2
4
$\dot{9}$ Denom. ( 3
9
$= \frac{2}{3}$, *Ans.*

15. $\dot{4}$ Num. ( 2
4
$2\dot{5}$ Denom. ( 5
25
$= \frac{2}{5}$, *Ans.*

16. $1\dot{6}$ Num. ( 4
16
$\dot{1}0\dot{0}$ Denom. ( 10
1
00
$= \frac{4}{10}$, *Ans.*

17. $8\dot{1}$ Num. ( 9
81
$\dot{1}4\dot{4}$ Denom. ( 12
1
22 ) 44
44
$= \frac{9}{12}$, *Ans.*

18. $2\dot{0}$'$2\dot{5}$ ( 4'5, *Ans.*
16
85 ) 425
425

19. '$7\dot{5}$ ('866+, *Ans.*
64
166 ) 1100
996
1726 ) 10400
10356
44

20. $\frac{5}{6}$ = '$8\dot{3}3\dot{3}3\dot{3}$ ( '912 +, *Ans.*
81
181 ) 233
181
1822 ) 5233
3644
1589

## SUPPLEMENT TO THE SQUARE ROOT.

### EXERCISES.

1. $4\dot{0}9\dot{6}$ ( 64, *A.*
36
124 ) 496
496

2. $2\dot{0}2\dot{5}$ ( 45 *A.*
16
85 ) 425
425

3. $5\dot{6}2\dot{5}$ ( 75, *A.*
49
145 ) 725
725

4. $5\dot{1}8\dot{4}$ ( 72, *A.*
49
142 ) 284
284

5. 40 + 50 = 90 × 160 (rods in 1 acre) = $\dot{1}4\dot{4}0\dot{0}$ r. ( 120 r., *A.*
1
22 ) 44
44
00

6. 20×20=400 rods, which ×4 = $1\dot{6}0\dot{0}$ ( 40 r. *A.*
16
00

7. 5 × 5 = 25, which × 4 = $\dot{1}0\dot{0}$ ft. ( 10 ft., &c., *A.*
1
00

8. $\frac{1}{2}$ of 288 r. $= \sqrt{144} = 12$ r. square. Two such fields, laid side by side, form a parallelogram 24 rods in length and 12 rods in breadth, *Ans.*

9. $\frac{1}{4}$ of 784 $= \sqrt{196} = 14$ rows of trees each way, and 4 such, laid side by side, would form an orchard of 14 rows and $(14 \times 4 =)$ 56 trees in a row, *Ans.*

10. $\frac{3}{4}$ of 192 $= \sqrt{144} = 12$ rods square. The other 48 rods ($\frac{1}{4}$ of 192) will extend this field on one side $(48 \div 12 =)$ 4 rods, forming a field 12 rods in breadth and 16 rods in length, *Ans.*

12. $\sqrt{100 \times 100 \times 3} = 173'2 +$ feet, *Ans.*

13. $\sqrt{12 \times 12 \div 4} = 6$ inches, *Ans.*

**¶ 109.** 15. $6^2 = 36$, and $8^2 = 64$; then, $\sqrt{36 + 64} =$ 10 feet, *Ans.*

16. $32^2 = 1024$, and $24^2 = 576$; then, $\sqrt{1024 + 576} =$ 40 feet, *Ans.*

17. $40^2 = 1600$, and $32^2 = 1024$; then, $\sqrt{1600 - 1024}$ $= 24$ feet, *Ans.*

18. $40^2$ (length of the ladder) $= 1600$, and $24^2$ (width of the ditch) $= 576$; then, $\sqrt{1600 - 576} = 32$ feet, *Ans.*

19. By the question, each rafter becomes the hypotenuse of a right-angled triangle, with a perpendicular (12 feet) common to both. One half of the beam (16 feet) is base to the one, and the other half, base to the other. $12^2 = 144$, and $16^2 = 256$; then, $\sqrt{144 + 256} = 20$ feet, *Ans.*

20. The projection of the eaves 1 foot each way will make the length of the roof 32 feet, and the breadth 24 feet. A diagonal line, extending from corner to corner, will be the hypotenuse of a horizontal right-angled triangle, of which the length and the breadth of the roof will form the two sides. Half the length of this line will be the distance from the post to the corners of the eaves. $32^2 = 1024$, and $24^2 = 576$; then, $\sqrt{1024 + 576} = 40$ ft., the half of which, 20 ft., is the distance from the post to the corners of the eaves. Length of a rafter to the middle of one side, $10^2 = 100$, and $12^2 = 144$; then, $\sqrt{100 + 144} = 15'62 +$ ft., *Ans.* —— rafter reaching to the middle of one end, $10^2 = 100$, and $16^2 = 256$; then, $\sqrt{100 + 256} = 18'86 +$, *Ans.* —— rafter reaching to the corners of the eaves, $10^2 = 100$, and $20^2 = 400$; then, $\sqrt{100 + 400} = 22'36 +$ feet, *Ans.*

21. $800^2 = 640000$, and $600^2 = 360000$; then, $\sqrt{640000 + 360000} = 1000$ rods between the corners, *Ans.*

22. $\sqrt{90 \times 160} = 120$ rods each side; $\sqrt{120^2 \times 2} =$ 169‘7 rods from corner to corner, *Ans.*

23. $\sqrt{10 \times 160} = 40$ rods each side of the field, and $\sqrt{40^2 \times 2} =$ 56‘56 rods, $\div 2 =$ 28‘28 rods, distance of the centre from each corner, *Ans.*

---

# EXTRACTION OF THE CUBE ROOT.

## ¶ 110. EXAMPLES FOR PRACTICE.

7.

$$\begin{array}{rrl}
 & 37\dot{3}24\dot{8} & (\ 72,\ \textit{Ans.} \\
 & \underline{343\phantom{00}} & \\
7^2 \times 300 = 14700\ ) & \underline{30248} & \\
14700 \times 2 = & 29400 & \\
2^2 \times 7 \times 30 = & 840 & \\
2 \times 2 \times 2 = & \underline{8} & \\
 & \underline{30248} & \\
 & 00000 &
\end{array}$$

8.

$$\begin{array}{rrl}
 & 2\dot{1}02\dot{4}57\dot{6} & (\ 276,\ \textit{Ans.} \\
2 \times 2 \times 2 = & \underline{8\phantom{000000}} & \\
2^2 \times 300 = 1200\ ) & \underline{13024} & \text{, 2d dividend.} \\
1200 \times 7 = & 8400 & \\
7^2 \times 2 \times 30 = & 2940 & \\
7 \times 7 \times 7 = & \underline{343} & \\
 & \underline{11683} & \\
27^2 \times 300 = 218700\ ) & \underline{1341576} & \text{, 3d dividend.} \\
218700 \times 6 = & 1312200 & \\
6^2 \times 27 \times 30 = & 29160 & \\
6 \times 6 \times 6 = & \underline{216} & \\
 & \underline{1341576} & \\
 & 0000000 &
\end{array}$$

9. $8\dot{4}'60\dot{4}51\dot{9}$ (4'39, *Ans.*

$4 \times 4 \times 4 = 64$

$4^2 \times 300 = 4800\ )\ 20604$

$4800 \times 3 = 14400$

$3^2 \times 4 \times 30 = 1080$

$3 \times 3 \times 3 = 27$

$15507$

$43^2 \times 300 = 554700\ )\ 5097519$

$554700 \times 9 = 4992300$

$9^2 \times 43 \times 30 = 104490$

$9 \times 9 \times 9 = 729$

$5097519$

$0000000$

10. $'00\dot{0}34\dot{3}$ ( '07, *A.*

$000$

$343$

$7 \times 7 \times 7 = 343$

$000$

11. $\dot{2}$ ( 1'25 +.

$1 \times 1 \times 1 = 1$

$1^2 \times 300 = 300\ )\ 1000$

$300 \times 2 = 600$

$2^2 \times 1 \times 30 = 120$

$2 \times 2 \times 2 = 8$

$728$

$12^2 \times 300 = 43200\ )\ 272000$

$43200 \times 5 = 216000$

$5^2 \times 12 \times 30 = 9000$

$5 \times 5 \times 5 = 125$

$225125$

$46875$

12. $\dot{8}$ (2

$2 \times 2 \times 2 = 8$

$2\dot{7}$ (3

$3 \times 3 \times 3 = 27$

$\Big\} = \frac{2}{3}$, *A.*

13. $12\dot{5}$ (5

$5 \times 5 \times 5 = 125$

$21\dot{6}$ (6

$6 \times 6 \times 6 = 216$

$\Big\} = \frac{5}{6}$, *A.*

14. $34\dot{3}$ (7

$7 \times 7 \times 7 = 343$

$\dot{1}72\dot{8}$ (12

$1$

$1^2 \times 300 = 300\ )\ 728$

$300 \times 2 = 600$

$2^2 \times 1 \times 30 = 120$

$2 \times 2 \times 2 = 8$

$728$

$000$

$\Big\} = \frac{7}{12}$.

15. $\frac{1}{500} = {}'\dot{2}\,(\,{}'125+$, *Ans.*

$$\begin{array}{rr}
 & 1 \\ \hline
1^2 \times 300 = 300\ ) & 1000 \\ \hline
300 \times 2 = & 600 \\
2^2 \times 1 \times 30 = & 120 \\
2 \times 2 \times 2 = & 8 \\ \hline
 & 728 \\ \hline
12^2 \times 300 = 43200\ ) & 272000 \\ \hline
43200 \times 5 = & 21\dot{6}000 \\
5^2 \times 12 \times 30 = & 9000 \\
5 \times 5 \times 5 = & 125 \\ \hline
 & 225125 \\ \hline
 & 46875
\end{array}$$

16.
$$\left.\begin{array}{rl}
 & \dot{1}\ (\,1 \\
 & 1 \\ \hline
 & 12\dot{5}\ (\,5 \\
5\times5\times5 = & 125 \\ \hline
\end{array}\right\} = \tfrac{1}{5},\ \textit{Ans.}$$

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## SUPPLEMENT TO THE CUBE ROOT.

### EXERCISES.

1. $288 \times 216 \times 48 = \dot{2}98\dot{5}98\dot{4}\ (\,144$ ft., *Ans.*

$$\begin{array}{rr}
 & 1 \\ \hline
1^2 \times 300 = 300\ ) & 1985 \\ \hline
300 \times 4 = & 1200 \\
4^2 \times 1 \times 30 = & 480 \\
4 \times 4 \times 4 = & 64 \\ \hline
 & 1744 \\ \hline
14^2 \times 300 = 58800\ ) & 241984 \\ \hline
58800 \times 4 = & 235200 \\
4^2 \times 14 \times 30 = & 6720 \\
4 \times 4 \times 4 = & 64 \\ \hline
 & 241984 \\ \hline
 & 000000
\end{array}$$

2. $2 \times 2 \times 2 = 8$ ft., *Ans.*

3. 8 ft. × 8 (times) $= 6\dot{4}$ (solid ft.) 4 ft. = one side;
$4 \times 4 \times 4 = \underline{64}$

4. $5 \times 5 \times 5 = 125$, which $\times\, 27 =$

$$\begin{array}{rl}
 & \dot{3}37\dot{5}\ (\ 15 \text{ ft.} = \text{one side, \&c.} \\
 & 1 \\
1^2 \times 300 = 300\ ) & \overline{2375} \\
300 \times 5 = & 1500 \\
5^2 \times 1 \times 30 = & 750 \\
5 \times 5 \times 5 = & 125 \\
 & \overline{2375} \\
 & \overline{0000}
\end{array}$$

5. $1^3 = 1$, which $\times$ 8 (times) $= 8$ ( 2 ft., *Ans.*
$2 \times 2 \times 2 = \underline{8}$

Or, ——— $\dot{2}7$ ( 3 ft., *Ans.* Or, ——— 64 ( 4 ft., *Ans.*
$3 \times 3 \times 3 = \underline{27}$ $4 \times 4 \times 4 = \underline{64}$

**¶ 111.** 6. As $4 : 32 :: (3^3 =)\ 27 : 21\dot{6}$ ( 6 in., *Ans.*
$6 \times 6 \times 6 = \underline{216}$

7. As $(6^3 =)\ 216 : (3^3 =)\ 27 :: 32$ lb. : 4 lb., *Ans.*

8. $1^3$ in. $= 1$ in., and (1 ft. $=$) $12^3$ in. $= 1728$ in. diam.; then, As 1 in. : 1728 in. :: \$6 : \$10368, *Ans.*

9. $(40^3 =)\ 64000 \div (1^3 =)\ 1 = 64000$ of the smaller, *Ans.*

10. $112^3 = 1404928$ globes, large as the earth, to make one as large as the sun, *Ans.*

11. $7900^3$ (the earth's diam.) $= 493039000000 \times 1000 =$

$$\begin{array}{rl}
 & 49\dot{3}039\dot{0}00000\dot{0}\ (\ 79000 \text{ miles, diam. of Saturn, } \textit{Ans.} \\
7^3 = & 343 \\
7^2 \times 300 = 14700\ ) & \overline{150039} \\
14700 \times 9 = & 132300 \\
9^2 \times 7 \times 30 = & 17010 \\
9^3 = & 729 \\
 & \overline{150039} \\
 & \overline{000000}
\end{array}$$

12. $\left.\begin{array}{l} 2^3 = 8 \\ 9^3 = 729 \end{array}\right\} = \frac{8}{729}$, or as 8 to 729, *Ans.*

---

## ARITHMETICAL PROGRESSION.

**¶ 112.** 2. $100 - 1 = 99 \times 3 = 297 + 4 = 301$, *Ans.*

3. $41 - 1 = 40 \times 2 = 80 + 1 = 81$, *Ans.*

4. Here 40 is the number of terms less one, ‘06 the common difference, and \$1‘00 the first term; then, 40 × ‘06 = 2‘40 + 1‘00 = \$3‘40, *Ans.*

6. $605-5=600\div\overline{151-1}=4$, *Ans.*

7. $3‘40-1‘00=2‘40\div\overline{41-1}=‘06$, *Ans.*

8. $45-10=35\div\overline{8-1}=5$, *Ans.*

10. $605+5=610\div2=305\times151=46055$, *Ans.*

11. $100+1=101\div2=50\frac{1}{2}\times100=5050$, *Ans.*

12. 1 and 12 are the extremes; then, $12+1=13\div2=6\frac{1}{2}\times12$, (number of terms,) $=78$, *Ans.*

13. $107+50=157\div2=78\frac{1}{2}\times20=\$1570$, *Ans.*

14. $40-1=39\times‘05=1‘95\times100=195‘00+100=295‘00$, the last term; then, $295‘00$ (the last term) $+100‘00$ (first term) $=395‘00$, which $\div2=197‘50\times40=\$7900$, *Ans.*

15. $81+1=82\div2=41\times41=1681$, *Ans.*

16. The extremes are 30 and 0; then, $30+0=30\div2=15\times20=300$, *Ans.*

17. $75+5=80\div2=40\times11=\$440$, whole debt; and $75-5=70\div\overline{11-1}=\$7$, common difference, *Ans.*

18. $1001+1=1002\div2=501\times501$ (number of terms) $=251001$, *Ans.*

19. $50-1=49\times\frac{1}{2}=24\frac{1}{2}+2=26\frac{1}{2}$, last term; then, $26\frac{1}{2}+2=28\frac{1}{2}\div2=14\frac{1}{4}\times50=712\frac{1}{2}$, *Ans.*

20. $30+0=30\div2=15\times91=1365$, *Ans.*

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# GEOMETRICAL PROGRESSION.

¶ **113.** 3. NOTE. *The 4 kernels planted is the first term, and the 32 kernels harvested the second, both within the first year; it follows, therefore, that the number of terms in this example is one more than the number of years; consequently, there is a mistake in the Arithmetic: in place of* 16*th, read* 15*th year, to bring out the answer there given.*

$$\left.\begin{matrix}\text{Indices:} & 1, & 2, & 3, & 4, & 5,\\ \text{Powers:} & 8, & 64, & 512, & 4096, & 32768;\end{matrix}\right\}$$
then, $1+2+3+4+5=15$, an index less by one than the number of terms; multiplying the powers of these several indices, we have $32768\times4096=134217728\times512=68719476736\times64=4398046511104\times8=35184372088832$, which $\times4$ (the first term) $=140737488355328$, number of kernels, $\div1000$ (number of kernels in a pint) $=140737488355‘328$ pints $\div64$ (No. pints in a bushel) $=2199023255‘552$ bushels, *Ans.*

4. $1824-1620=204\div12=17$, number of terms, less one; then, $2^{17}=131072\times‘01=\$1310‘72$, *Ans.*

7. $3-0=3\div\overline{3-1}=1\frac{1}{2}+3=4\frac{1}{2}$, *Ans.*

8. $1-0=1\div\overline{4-1}=\frac{1}{3}+1=1\frac{1}{3}$, *Ans.*

9. $\frac{1}{10}-0=\frac{1}{10}\div\overline{10-1}=\frac{1}{90}+\frac{1}{10}\;(=\frac{9}{90})=\frac{10}{90}=\frac{1}{9}$, *Ans.*

10. $\frac{2}{100}-0=\frac{2}{100}\div\overline{100-1}=\frac{2}{9900}+\frac{2}{100}=\frac{200}{9900}=\frac{2}{99}$, *Ans.*

11. $\left\{\begin{array}{l}\text{Indices: } 1,\ 2,\ 3,\ 4,\ 5, \\ \text{Powers: } 3,\ 9,\ 27,\ 81,\ 243;\end{array}\right\}$ $5+4+2=11$, an index less by one than the number of terms; multiplying the powers, we have $243 \times 81 = 19683 \times 9 = 177147$, the last term; then, $177147 - 1 = 177146 \div \overline{3-1} = 88573 + 177147 =$ 265720, *Ans.*

12. $10^{40}=1$ with forty ciphers annexed, which — 1 would = forty 9s; then $\div\ \overline{10-1}$ = forty 1s, the number of kernels, which ÷ 1000 = number of pints, and this dividend ÷ 64, (number of pints in a bushel,) = number of bushels, which × ‘50 = *Ans.*

### *Compound Interest by Progression.*

**¶114.** 3. $\$1{‘}10^4 = \$1{‘}4641 \times \$6 = \$8{‘}7846$, *Ans.*

5. $\$8{‘}7846 \div 1{‘}4641\ (1{‘}10^4) = \$6$, *Ans.*

6. $\$68{‘}40 \div 1{‘}71\ (1{‘}05^{11}) = \$40$, *Ans.*

9. $\$68{‘}40 \div 40 = \sqrt[T]{1{‘}71} =$ (¶91, Table,) 11 years, *Ans.*

10. $\$5{‘}352 \div 4 = \sqrt[T]{1{‘}338} =$ (¶91,) 5 years, *Ans.*

### *Annuities at Compound Interest.*

**¶115.** 2. $\dfrac{1{‘}05^{20}-1}{1{‘}05-1} = (\P 91,)\dfrac{2{‘}65329-1}{1{‘}05-1} = \dfrac{1{‘}65329}{{‘}05}$ $= 33{‘}0658 \times \$50$ (the annuity) $= \$1653{‘}29$, *Ans.*

3. $\dfrac{1{‘}10^4-1}{1{‘}10-1} = (\P 91,)\ \dfrac{1{‘}4641-1}{1{‘}10-1} = \dfrac{{‘}4641}{{‘}10} = 4{‘}641 \times$ $\$150$ (the annuity) $= \$696{‘}15$, *Ans.*

4. $\dfrac{1{‘}06^{24}-1}{1{‘}06-1} = \dfrac{4{‘}048930-1}{1{‘}06-1} = \dfrac{3{‘}048930}{{‘}06} = 50{‘}8155$ $\times\ \$500 = \$25407{‘}75$, *Ans. to the last.*

**¶116.** 5. $\dfrac{1{‘}06^4-1}{1{‘}06-1} = \dfrac{1{‘}26247-1}{1{‘}06-1} = \dfrac{{‘}26247}{{‘}06} = 4{‘}3745$ $\times\ 100 = 437{‘}45$, the amount in arrears for the whole time, which $\div\ 1{‘}26247\ (1{‘}06^4) = \$346{‘}51$, *Ans.*

6. $\dfrac{1{‘}05^{20}-1}{1{‘}05-1} = \dfrac{2{‘}65329-1}{1{‘}05-1} = \dfrac{1{‘}65329}{{‘}05} = 33{‘}0658 \times \$100$ $= 3306{‘}58$, amount in arrears, which $\div\ 2{‘}65329\ (1{‘}05^{20})$ $= \$1246{‘}22$, *Ans.*

8. $\$16{‘}1929$, from table above, which $\times 4 = \$647{‘}716$, *A.*

11. *The last.* Present worth, to commence immediately, 1246‘221, which $\div 1{‘}97993\ (1{‘}05^{14}) = \$629{‘}426$, *Ans.* Or,

by the table, Whole time, 34 years, = $16‘1929
Time in reversion, 14 years, = $ 9‘89864

Difference, $6‘29426, which × 100 (the annuity) = $629‘426, *Ans.* as before.

¶ **117.** 15. $\frac{100}{‘05}=2000$, worth, if entered on now, which, diminished by the present worth of $100 for thirty years, $1537‘245 = $462‘755, *Ans.*

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## PERMUTATION.

¶ **118.** 2. $1\times2=2\times3=6\times4=24\times5=120\times6=720\times7=5040\times8=40320\times9=362880$, *Ans.*

3. $1\times2=2\times3=6\times4=24\times5=120\times6=720\times7=5040\times8=40320\times9=362880\times10=3628800\times11=39916800\times12=479001600\times13=6227020800\times14=87178291200\times15=1307674368000\times16=20922789888000\times17=355687428096000\times18=6402373705728000\times19=121645100408832000\times20=2432902008176640000\times21=51090942171709440000\times22=1124000727777607680000\times23=25852016738884976640000\times24=620448401733239439360000\times25=15511210043330985984000000$, *Ans.*

4. $1\times2=2\times3=6\times4=24\times5=120\times6=720\times7=5040\times8=40320$, *Ans.*

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## MISCELLANEOUS EXAMPLES.

¶ **119.** 5. $78\times25=1950$, the greater, and $1950-(15\times9=)\ 135=1815$, the less; then $1950+1815=3765$, sum; and $1950\times1815=3539250$, product, *Ans.*

7. $12\times12\times6=864-(6\times12)\ 72=792$, *Ans.*

8. $6488\times7=45416$, *Ans.*

9. $2058\div6=343$, *Ans.*

10. $17+8+35+40=100$, *Ans.*

14. $(\frac{5}{6}=)\ \frac{25}{30}-(\frac{2}{5}=)\ \frac{12}{30}=\frac{13}{30}$, *Ans.*

15. $(\frac{3}{5}=)\ \frac{24}{40}+(\frac{1}{8}=)\ \frac{5}{40}=\frac{29}{40}$, *Ans.*

16. $21\times\frac{3}{4}=15\frac{3}{4}$, *Ans.*

17. $\frac{1}{4}\div\frac{2}{3}\ (\frac{3}{2}\text{ of }\frac{1}{4})=\frac{3}{8}$, *Ans.*

18. $12\div3=4$, one fifth, which $\times5=20$, *Ans.*

19. $20=\overline{\frac{2}{5}\times\frac{5}{3}+1}=\frac{5}{3}$; then, $20\div\frac{5}{3}=12$, *Ans.*

20. $9\div\frac{2}{3}=13\frac{1}{2}$, *Ans.*

|  |  |  |
|---|---|---|
| 21. | 780 × ‘06 = $ 46‘80<br>250 × ‘08 = $ 20‘00<br>154 × ‘15 = $ 23‘10 | 60 × ‘10 = $ 6‘00<br>‘42 × 15 = $ 6‘30<br>4 × 1‘25 = $ 5‘00<br>$ 3‘75 |
|  | Sold, $ 89‘90 — | Bought, $ 21‘05 = $ 68‘85, Balance. |
| 22. | 75 × 1‘45 = $ 108‘75<br>64 × ‘95 = $ 60‘80<br>142 × ‘50 = $ 71‘00 | 31 × 3 × 1‘75 = $ 162‘75<br>2 × 2‘30 = $ 4‘60<br>8 × 4‘30 = $ 34‘40 |
|  | Sold, $ 240‘55 — | Bought, $ 201‘75 = $ 38‘80, Bal. |

23. 670 × ‘375 = $285‘00 — (66½ × 4) $266‘00 = $19‘00, *A.*

24. $1‘25 × 84 = $105‘00, whole cost, which ÷ $1‘50 = 70 bushels, *Ans.*

25. 342 × ‘06 = $20‘52, which ÷ ‘375 = 54‘72 gallons, *A.*

26. ‘92 × 70 = $ 64‘40 — (1‘375 × 40) $ 55‘00 = $9‘40, which ÷ ‘40 = 23‘5 bushels, *Ans.*

27. 32 × (2 s. 6 d.) 30 d. = 960 d. ÷ (1 s. 6 d.) 18 d. = 53⅓ bushels, *Ans.*

28. 15 × (2 s. 3 d.) 27 d. = 405 d. ÷ ($1‘50 × 6 × 12) 108 d. = 3¾ bushels, *Ans.*

29. 40 × (7 s. 6 d.) 90 d. = 3600 d. ÷ ($ 2‘75 × 6 × 12) 198 d. = 18 2/11 gals., *Ans.*

30. 41 × 30 = 1230 s. — (20 £. × 20) 400 s. = 830 s. × 12 = 9960 d. ÷ 5 d. = 1992 lbs. = 17 cwt. 3 qrs. 4 lbs., *Ans.*

32. 2 s. : 2½ s. :: 8 s. : 10 s. *Ans.*

33. $ 2‘00 ÷ 4 = ‘50, *Ans.*

34. $13‘50 ÷ 9 = $1‘50, *Ans.*

35. $100 ÷ 40 = $ 2‘50, *Ans.*

36. (7 s. 6 d.) 90 d. ÷ 3 = 30 d. = 2 s. 6 d., *Ans.*

37. 21 £. 9 s. = 429 s. ÷ 22 = 19½ = 19 s. 6 d., *Ans.*

38. $ 2‘00 ÷ ‘50 = 4 bushels, *Ans.*

39. $100 ÷ $ 2‘50 = 40, *Ans.*

40. $300 ÷ 20 = $15, price of one, which × 15 = $225, *A.*

41. 7 : 10 :: 24 : *A.** = 24 × 10 = 240 ÷ 7 = 34 2/7, *Ans. to the last.*

42. $100 : $ 75 :: $ 6 : *A.* = 75 × 6 = 450 ÷ 100 = $ 4‘50, *Ans.*

43. $ 2475 × ‘005 = $12‘375, *Ans.*

44. $ 9876‘40 × ‘015 = $148‘146, *Ans.*

45. $ 478 × ‘08 = $ 38‘24, *Ans.*

46. $ 734 × ‘21 = $154‘14, gain; then, $734 + $154‘14 = $ 888‘14, the price at which he sold them, *Ans.*

47. $ 500 + $ 43 = $ 543 × ‘24 = $130‘32, to which + $ 543 = $ 673‘32, *Ans.*

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* Answer.

48. $ 64 × ‘12 = $ 7‘68, discount; then, $ 64 — $ 7‘68 = $ 56‘32, *Ans.*

49. $4‘50 × ‘33$\frac{1}{3}$ = $1‘50; then, $4‘50 — $1‘50 = $3‘00, *A.*

50. $42 × ‘15 = $6‘30; then, $42 + $6‘30 = $48‘30, price of the whole, and $ 48‘30 ÷ 120 = ‘40$\frac{1}{4}$, *Ans. to the last.*

51. $59‘20 ÷ 4 (¶ 29) = $14‘80, to which + $ 59‘20 = $ 74‘00 ÷ 740 = ‘10, *Ans.*

52. $ 71‘02 × ‘087 = $ 6‘178, *Ans.*

53. $ 487‘003 × ‘09 = $ 43‘83, *Ans.*

54. $ 8‘50 × ‘035 = $ ‘297$\frac{1}{2}$, *Ans.*

55. $ 1000 × ‘000$\frac{5}{6}$ = $ ‘833$\frac{1}{3}$, *Ans.*

56. $ ‘50 × ‘06 = ‘0300 × 10 = $ ‘30, *Ans.*

57. $ 84‘25 × ‘076$\frac{1}{6}$ = $ 6‘417 ÷ $\frac{6}{7}$ = $ 7‘4865, *Ans.*

58. $150‘01 × ‘140$\frac{1}{2}$ = $ 21‘6384 ÷ $\frac{6}{5}$ = $ 18‘032, *Ans.*

59. $ 150 ÷ $1‘15 = $130‘434, *Ans.*

60. $ 475‘50 ÷ $1‘08 = $ 440‘277, *Ans.*

61. $100 ÷ $1‘25 = $ 800, *Ans.*

62. $ 575 — $500 = $75, whole gain; then, $500 : 1‘00 :: $75 : *A.* = 1‘00 × 75 = 75‘00 ÷ 500 = ‘15, *Ans.*

63. $ 4‘25 — $ 3‘50 = ‘75, whole gain; then, $ 3‘50 : 1‘00 :: ‘75 : *A.* = 1‘00 × ‘75 = ‘7500 ÷ 3‘50 = 21$\frac{3}{7}$, *Ans.*

64. 126 × $ 2‘75 = $ 346‘50 — $283‘50 = $63‘00, whole gain; then, $ 63‘00 ÷ 126 = ‘50, gain per gallon; and $283‘50 : 1‘00 :: $ 63‘00 : *A.* = $ 63‘00 × 1‘00 = $ 63‘0000 ÷ $ 283‘50 = 22$\frac{2}{9}$ per cent., *Ans.*

65. $ 6 : $14 :: 12 : *A.* = 14 × 12 = 168 ÷ 6 = 28 months, *Ans. to last.*

66. $ 2‘18 ÷ $ 8‘27 (¶ 89) = ‘666$\frac{218}{327}$ of a year, × 12 = 8 months, *Ans.*

68. 28 : 7 :: 8 : *A.* = 7 × 8 = 56 ÷ 28 = 2 weeks, *A.*

69. 16 : 20 :: 8 : *A.* = 20 × 8 = 160 ÷ 16 = 10 rods, *A.*

70. 1$\frac{1}{2}$ : $\frac{5}{8}$ :: 12 : *A.* = 12 × $\frac{5}{8}$ = $\frac{60}{8}$, which ÷ (1$\frac{1}{2}$ =) $\frac{3}{2}$ ($\frac{2}{3}$ of $\frac{60}{8}$) = $\frac{120}{24}$ = 5 years, *Ans.*

71. $ 75 : $ 460 :: 5 : *A.* = 460 × 5 = 2300 ÷ 75 = 30$\frac{2}{3}$ months, *Ans.*

72. $ 540 × ‘75 = $ 405, *Ans.*

73. $\frac{7}{5}$ — $\frac{2}{6}$ = $\frac{32}{30}$ of a gallon in one minute; then, 400 ÷ $\frac{32}{30}$ = 375 minutes = 6 hours, 15 minutes, *Ans.*

74. $\frac{1}{10}$ — $\frac{1}{15}$ = $\frac{1}{30}$ part filled in one hour; then, 1 ÷ $\frac{1}{30}$ = 30 hours, *Ans.*

75. 5 : 40 :: 1 : *A.* = 40 ÷ 5 = 8 pipes, *Ans.*

76. $ 300 : $ 500 :: 4 : *A.* = 500 × 4 = 2000 ÷ 300 = 6$\frac{2}{3}$ months, *Ans.*

77. 5 : 2 :: 800 : *A.* = 800 × 2 = 1600 ÷ 5 = 320, No. that can be *served* 5 *months;* then, 800 — 320 = 480, *Ans.*

78. 7 : 6 :: $ 84 : *A.* = 84 × 6 = 504 ÷ 7 = $ 72, *A.*

79. 45 — 16 = 29 × $ 3‘50 = $101‘50, cost of the better kind; and 16 × $\frac{3}{4}$ = 12 × $ 3‘50 = $ 42‘00, cost of the poorer kind; then, $101‘50 + $ 42‘00 = $143‘50, *Ans.*

80. $110 ÷ 75 = $146\frac{2}{3}$ — 126 = $20\frac{2}{3}$ gal., *Ans.*

81. 8 — 6 = 2, gain an hour; then, 24 ÷ 2 = 12 hours, *A.*

82. 12 + 45 (36 × $1\frac{1}{4}$) = 57 rods, distance to be gained by the hound; then, 57 ÷ 4 (40 — 36) = $14\frac{1}{4}$ minutes; and 40 × $14\frac{1}{4}$ = 570 rods, *second, Ans.*

83. 11 : 12 :: 1 : *A.* = 12 ÷ 11 = $1\frac{1}{11}$ hours, = 1 hour, 5 minutes, $27\frac{3}{11}$ seconds, *Ans.*

84. B travels twice, and C three times, as fast as A; therefore, when A has travelled round once, B will have been round twice, and C three times, and there they will all be together for the first time; therefore, 20 ÷ 2 = 10, number of hours A will be in passing round once. *Ans.* 10 hours.

86. One moves 6, and the other 10 miles per hour, and both together 16; then, one will go $\frac{6}{16}$, and the other $\frac{10}{16}$, of the whole distance; therefore, 300 × $\frac{6}{16}$ = $112\frac{1}{2}$, and 300 × $\frac{10}{16}$ = $187\frac{1}{2}$; or, 16 : 6 :: 300 : $112\frac{1}{2}$ miles, and 16 : 10 :: 300 : $187\frac{1}{2}$ miles, *Ans.*, as before.

87. 126 gal. — $4\frac{1}{2}$ gal. $(\overline{4 \times 2 \div 4} + \overline{6 \times 3 \div 2 \div 4})$ = $121\frac{3}{4}$ gal. to be sold; then, $275 × ‘30 = $82‘50 (percentage,) to which + $ 275 = $ 357‘50, sum for which he would sell the whole, which ÷ $121\frac{3}{4}$ gal. = $ 2‘936 per gal., *Ans.*

88. 150 ÷ 3 (¶ 29) = $ 50, sum which each received; then, $ 50 ÷ ‘25 = 200, number of melons, *Ans.*

90. 1 — $\frac{15}{24}$ $(\overline{\frac{1}{4} + \frac{1}{6} + \frac{1}{8} + \frac{1}{12}})$ = $\frac{9}{24}$; then 450 is $\frac{9}{24}$ of the whole; therefore, 450 ÷ 9 = 50 × 24 = 1200, *Ans.*

91. 1 — $\frac{7}{12}$ $(\overline{\frac{1}{4} + \frac{1}{3}})$ = $\frac{5}{12}$, *Ans.*

92. 1 — $\frac{14}{15}$ $(\frac{1}{3} + \frac{3}{5})$ = $\frac{1}{15}$; 6 is $\frac{1}{15}$; then, 6 × 15 = 90 ft., *A.*

93. 1 — $\frac{71}{80}$ $(\overline{\frac{1}{16} + \frac{3}{8} + \frac{3}{10} + \frac{3}{20}})$ = $\frac{9}{80}$; 9 is $\frac{9}{80}$ of the whole; then, 9 ÷ 9 = 1 × 80 = 80, whole number; and 80 × $\frac{1}{16}$ = 5, in grammar; and 80 × $\frac{3}{8}$ = 30, in geography; and 80 × $\frac{3}{10}$ = 24, in arithmetic; and 80 × $\frac{3}{20}$ = 12, in writing, and 9 in reading, *A.*

94. 100 — $2\frac{1}{2}$ = $97\frac{1}{2}$, which is $\frac{3}{2}$ of the whole flock; and $97\frac{1}{2}$ ÷ 3 = $32\frac{1}{2}$, which × 2 = 65 geese, *Ans.*

95. 1 — $\frac{11}{12}$ $(\overline{\frac{1}{2} + \frac{1}{4} + \frac{1}{6}})$ = $\frac{1}{12}$; then, 60 + 40 = 100 is $\frac{1}{12}$, and 100 × 12 = 1200, *Ans.*

96. 1 — $\frac{11}{12}$ $(\overline{\frac{1}{2} + \frac{1}{4} + \frac{1}{6}})$ = $\frac{1}{12}$; then, 7 + 3 = 10 is $\frac{1}{12}$, and 10 × 12 = 120, *Ans.*

98. $30 = 1 + \frac{1}{5} = \frac{6}{5}$ of the number sought; then, $30 \div 6 = 5, \times 5 = 25$, *Ans.*

99. $84 = \frac{7}{4}$ of the number; then, $84 \div 7 = 12 \times 4 = 48$, *A.*

100. $22 = (3 - 2\frac{4}{15} =)\ \frac{11}{15}$ of the number sought; then, $22 \div \frac{11}{15} = 30$, *Ans.*

101. $234\frac{3}{4} = 1 + \frac{2}{5} + \frac{3}{8} + \frac{5}{6} = \frac{313}{120}$ times the number sought; then, $234\frac{3}{4} = \frac{939}{4} \div \frac{313}{120}\ (\frac{939}{4} \times \frac{120}{313}) = \frac{112680}{1252} = 90$, *Ans.*

102. $93 = \overline{1 + 1\frac{1}{2} + 5\frac{1}{4}} = 7\frac{3}{4}$ times A's age; then, $93 \div 7\frac{3}{4} = 12$, A's; and $12 \times 1\frac{1}{2} = 18$, B's; and $12 \times 5\frac{1}{4} = 63$, C's, *A.*

103. $435 = \overline{1 + 1 + \frac{3}{4} + \frac{1}{2} + \frac{1}{4} + \frac{1}{6}} = \frac{29}{8}$ of his pupils; then, $435 \times 8 = 3480 \div 29 = 120$, *Ans.*

106. $\$40 \div \$8 = \$5$, what B spends more than his income, in a year; then, $\$30 - \$5 = \$25$, which must be $\frac{1}{8}$ of their income; $\$25 \times 8 = \$200$, whole income of each; and $\$200 \times \frac{7}{8} = \$175$, what A spends; and $\$175 + \$30 = \$205$, what B spends.

107. A has $\frac{1}{2} - \$20$, and C $\frac{1}{2} - \$30$; then, A and C have the whole $- \$50$, which must be B's share, or $\frac{1}{4}$; then, $\$50 \times 4 = \$200$, whole estate; and $200 \div 2 = 100 - 20 = \$80$, A's share; and $200 \div 4 = \$50$, B's share; and $200 \div 2 = 100 - 30 = \$70$, C's share.

108. The length of the body is $\frac{1}{2}$ the length of the whole fish; the length of the tail is $\frac{1}{4} + 4$ feet; and the head is 4 feet; then, $\frac{1}{2} + \frac{1}{4} + 4 + 4 = (\frac{3}{4} + 8 =)$ whole length of the fish, and consequently $8 = \frac{1}{4}$, and $8 \times 4 = 32$ feet, *Ans.*

109. A can do $\frac{1}{4}$, and B $\frac{1}{3}$, per day, and both, working together, $\frac{1}{4} + \frac{1}{3} = \frac{7}{12}$; then, $1 \div \frac{7}{12} = 1\frac{5}{7}$ days, *Ans.*

110. A and B can do $\frac{1}{4}$, B and C $\frac{1}{6}$, and A and C $\frac{1}{5}$ per day; then, $\frac{1}{4} + \frac{1}{6} + \frac{1}{5} = \frac{37}{60}$, which $\div 2$ (because each man, by the conditions, is taken twice) $= \frac{37}{120}$ what all would do in one day; then, $1 \div \frac{37}{120} = 3\frac{9}{37}$ days, *Ans.*

111. A and B together can do $\frac{1}{5}$, and A can do $\frac{1}{7}$ alone; then, $\frac{1}{7} - \frac{1}{5} = \frac{2}{35}$ what B can do in a day; then, $1 \div \frac{2}{35} = 17\frac{1}{2}$ days, *Ans.*

112. $\left.\begin{array}{l}\text{Am't. of \$1‘00 for (21—18) 3 yrs.} = \text{\$1‘18} \\ \text{Am't. of \$1‘00 for (21—14) 7 yrs.} = \text{\$1‘42}\end{array}\right\} = \text{\$2‘60.}$

Then, (as they will receive inversely as the time,)
As \$2‘60 : \$1‘42 : : \$1000 : \$546‘153, the elder B's share.
As \$2‘60 : \$1‘18 : : \$1000 : \$453‘846, the younger B's share.

113. ‘60 is the first term, ‘06 the common difference, and 5 the number of terms; then, (¶ 112) 4 × ‘06 = ‘24 × 60 = 14‘40 + 60 = 74‘40, the last term, and 74‘40 + 60 = \$134‘40 ÷ 2 = \$67‘20 × 5 = \$336, *Ans.*

114. 30 × 3 = 90 × ‘50 = \$45‘00, price of 100 yards calico;

and 45‘00 ÷ 100 = ‘45, price of one yard of calico, which × 40 = $18‘00 ÷ 36 (12×3) = ‘50, price of one pair of gloves; then, $4 ÷ ‘50 = 8 pairs, *Ans.*

115. B has 3, and C 7, more than A; 7 + 3 = 10, to be taken from 100 = 90 ÷ 3 = 30, A’s; then, 30 + 3 = 33, B’s, and 30 + 7 = $37, C’s share, *Ans.*

117. 30×4=120 qts.×2=240 pts.÷3 (2+1) = 80, *Ans.*

118. 12 cwt. 3 qrs. 12 lbs. = 1440 lbs. ÷ 24 (12 + 7 + 5) = 60, *Ans.*

119. 15 oz. 6 pwt. = 7344 grains ÷ 306 grains $(\overline{18 \times 12 \times 24})$ = 24, *Ans.*

120. 3 + 5 + 7 = 15 cents; then, the first will have $\frac{3}{15}$ of 60 = 12; the second, $\frac{5}{15}$ of 60 = 20; and the third, $\frac{7}{15}$ of 60 = 28, *Ans.*

121. 50 s. = 600 d. ÷ 30 d. (6 + 8 + 16) = 20, *Ans.*

122. 7 £. 17 s. 6 d. = 1890 d.; as there were 3 women to every boy, and 6 men to every boy, as often as he gave 6d. to the boy, he would give 8 d. × 3 = 24 d. to the women, and 16 d. × 6 = 96 d. to the men; then, 6 + 24 + 96 = 126 d.; 1890 d. ÷ 126 d. = 15 boys; and 15×3=45 women; 15×6=90 men, *A.*

123. $82‘50 = $\overline{1 + 8 + 24}$ = 33 times the price of the sheep; then, $82‘50 × $\frac{1}{33}$ = $2‘50, sheep; $82‘50 × $\frac{8}{33}$ = $20, cow; and 82‘50 × $\frac{24}{33}$ = $60, oxen, *Ans.*

124. $1764 × $\frac{2}{7}$ = $504, A’s; and $1764 × $\frac{15}{21}$ = $1260, B’s, *Ans.*

125. Each will have such part of the whole gain as his stock is of the whole stock; therefore, $2364 × $\frac{1}{2}$ = $1182, A’s; $2364 × $\frac{1}{4}$ = $591, B’s; $2364 × $\frac{1}{6}$ = $394, C’s; and $2364 × $\frac{1}{12}$ = $197, D’s, *Ans.*

126. 1 — $\frac{31}{40}$ $(\frac{2}{5}+\frac{3}{8})$ = $\frac{9}{40}$, what C furnished; then, $1250 × $\frac{2}{5}$ = $500, A’s; $1250 × $\frac{3}{8}$ = $468‘75, B’s; and $1250 × $\frac{9}{40}$ = $281‘25, C’s share, *Ans.*

127. First, to find the gain of A and B; C’s gain being $120, $332‘50 — 120 = $212‘50, the gain of A and B together; then, (¶ 98,) $850 : $500 :: $212‘50 : $125, A’s; and $850 : $350 :: $212‘50 : $87‘50, B’s. To find the price of C’s cloth per yard; if C’s share of the gain is $\frac{48}{133}$ of the whole gain, his share of the stock must have been $\frac{48}{133}$ of the whole; and 1 — $\frac{48}{133}$ = $\frac{85}{133}$ must be equal to A and B’s stock together, viz. $850; then, $850 ÷ 85 = $10, $\frac{1}{133}$ of the stock, which × 48 (C’s share) = $480, C’s stock, which ÷ 120 = $4 per yard, *Ans.*

128. As often as A paid 5 £., B paid 7 £., and C 10½ £.; 5+7+10½ = 22½ £.; then, (¶ 98,) 22½ £. : 5 £. :: 120 £. :

26 £. 13 s. 4 d., A's; $22\frac{1}{2}$ £. : 7 £. :: 120 £. : 37 £. 6 s. 8 d., B's; and $22\frac{1}{2}$ £. : $10\frac{1}{2}$ £. :: 120 £. : 56 £., C's, *Ans.*

129. As often as A has 9 £., B has 5 £., and C $\frac{3}{7}$ of £. 5, $= 2\frac{1}{7}$ £.; $9 + 5 + 2\frac{1}{7} = 16\frac{1}{7}$ £.; then, $2\frac{1}{7}$ £. : $16\frac{1}{7}$ £. :: $1537\frac{5}{8}$ £. : 11583 £. 8 s. 10 d. *Ans.*

130. 3 men 5 days = 15 men 1 day, and 7 men 3 days = 21 men 1 day; 15 + 21 = 36 days; $\frac{15}{36} = \frac{5}{12}$, A; $\frac{21}{36} = \frac{7}{12}$, B; then, \$ 54 $\times \frac{5}{12} =$ \$ 22‘50, A's money, and \$ 54 $\times \frac{7}{12} =$ \$ 31‘50, B's money, *Ans.*

131. 9 months : 12 months :: \$1200 : \$1600, *Ans.*

132. $\frac{2}{3} + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} = 1\frac{3}{4}$, paid by all; then, $1\frac{3}{4} : \frac{2}{3}$ :: 35 s. : 13 s. 4 d., A; $1\frac{3}{4} : \frac{1}{2}$ :: 35 s. : 10 s., B; $1\frac{3}{4} : \frac{1}{3}$ :: 35 s. : 6 s. 8 d., C; $1\frac{3}{4} : \frac{1}{4}$ :: 35 s. : 5 s., D, *Ans.*

133. $\frac{3}{4} + \frac{9}{10} + \frac{13}{20} = \frac{46}{20} \div 2$, (as each man's horses are taken twice in the question) $= \frac{23}{20}$; then, $\frac{23}{20} - \frac{3}{4}$ (A's and B's) $= \frac{8}{20}$, C's; $\frac{23}{20} - \frac{9}{10}$ (A's and C's) $= \frac{5}{20}$, B's; and $\frac{23}{20} - \frac{13}{20}$ (B's and C's) $= \frac{10}{20}$, A's; then, A will have $\frac{10}{23}$ of \$26‘45 = \$11‘50; B will have $\frac{5}{23}$ = \$5‘75, and C $\frac{8}{23}$ = \$9‘20.

134. $\frac{2}{5}$ of $\frac{5}{8} = \frac{10}{40} = \frac{1}{4}$, by which $\div$ 375 £. = 1500 £., *Ans.*

135. 450 £. $\div \frac{3}{8} =$ 1200 £., money he had *after* he bought his commission, to which + 1500 £. = 2700 £., what he had *before* he bought his commission; and this must be $\frac{5}{7}$ $(\frac{7}{7} - \frac{2}{7})$ of his fortune at first; then, 2700 £. $\div \frac{5}{7} =$ 3780 £., *Ans.*

136. 1560 £. $\div \frac{7}{12} = \frac{18720}{7}$ £., the elder brother's fortune, which $\times \frac{43}{8}$ $(5\frac{3}{8}) = \frac{804960}{56}$ £., which is $\frac{3}{8}$ of twice as much as the father was worth; then, $\frac{804960}{56} \div \frac{3}{8} = \frac{6439680}{168} \div 2 = \frac{3219840}{168}$ £. = 19165 £., 14 s. $3\frac{3}{7}$ d., *Ans.*

137. $\frac{3}{4}$ of $\frac{5}{6} = \frac{5}{8}$; then, 537 £. is $\frac{8}{8} - \frac{5}{8} = \frac{3}{8}$, and 537 £. $\div \frac{3}{8} =$ 1432 £., the sum he had after he had spent $\frac{5}{16}$ of his fortune, and consequently this must be $\frac{11}{16}$ of what he had at first; then, 1432 £. $\div \frac{11}{16} =$ 2082 £. 18 s. $2\frac{2}{11}$ d., *Ans.*

138. 95173000 × 8 = 761384000, which $\div$ 60, 60, 24, and $365\frac{1}{4}$ = 24 years, 46 days, 7 hours, 33 minutes, 20 seconds, *Ans.*

139. 231 + 1 = 232 + 44 = 276 $\div$ 2 = 138, number of men on a side after the addition; then, $138^2 = 19044 - 44 = 19000$, *Ans.*

140. 45 × 28 (number of shillings in a guinea) = 1260 s., which $\div$ 20 = 63 £.; then, 63 £. is $\frac{35}{100}$ of the whole adventure; 63 £. $\div \frac{35}{100} =$ 180 £.; 11 + 8 = 19; then, A will have $\frac{11}{19}$ of 180 £. = 104 £. 4 s. $2\frac{10}{19}$ d., and B will have $\frac{8}{19}$ of 180 £. = 75 £. 15 s. $9\frac{9}{19}$ d., *Ans.*

141. 3000 × 320 (rods in a mile) = 960000 × $16\frac{1}{2}$ =

15840000, number of feet across the Atlantic, which $\times \frac{1}{1625}$ $= 9747\frac{9}{13}$ grains $=$ 1 lb. 8 oz. 6 pwts. $3\frac{9}{13}$ grs., *Ans.*

142. $40 \times 40 = 1600$, the last number, which $\div 4 = 400$, the second number, and this $\div 4 = 100$, first number, *Ans.*

143. $100^2 - 80^2 = 10000 - 6400 = 3600$; then, $\sqrt{3600} = 60$, height of the steeple, which $\times 3 = 180$, height of the spire; to find the length of the line, $180^2 + 80^2 = 32400 + 6400 = 38800$, and $\sqrt{38800} = 197$, *Ans.*

144. $7\frac{1}{2}^2 + 10^2 = \frac{15}{2}^2 + \frac{20}{2}^2 = \frac{225}{4} + \frac{400}{4} = \frac{625}{4}$; then, $\sqrt{\frac{625}{4}} = \frac{25}{2} = 12\frac{1}{2}$ miles apart in one hour, which $\times 24 = 300$ in one day, which $\times 3 = 900$, *Ans. to last.*

145. $50^2 + 50^2 = \sqrt{5000} = 70‘71$, *Ans.*, nearly.

146. $70‘71^2 = 5000$, twice the area, which $\div 2 = 2500$ area; then, $\sqrt{2500} = 50$ rods, *Ans.*

147. $33\frac{1}{3}^2 - 20^2 = 1111\frac{1}{9} - 400 = 711\frac{1}{9} = \frac{6400}{9}$; then, $\sqrt{\frac{6400}{9}} = \frac{80}{3} = 26\frac{2}{3}$, length; then, $26\frac{2}{3} \times 20 = 533\frac{1}{3}$ rods, $=$ 3 acres, 1 rood, $13\frac{1}{2}$ rods, *Ans.*

149. $36 \times 9 = 324$ square feet; then, $\sqrt{324} = 18$ft., *A.*

150. $80 \times 20 = 1600 \div 160 = 10$ acres, *Ans.*

151. $10 \times 160 = 1600$ sq. rods, which $\div 20 = 80$ rods, *Ans.*

152. $10 \times 160 = 1600$ sq. rods, which $\div 80 = 20$ r., *Ans.*

153. $18 + 10 = 28 \div 2 = 14$, *Ans.*

155. Mean width, $\frac{2}{2} = 1$ ft.; then, $20 \times 1 = 20$ ft., *Ans.*

156. $40 \times 20 = 800 \div 2 = 400$ sq. r. $=$ 2 acres, 2 roods, *A.*

157. $30 \times 5\ (10 \div 2) = 150$ rods, *Ans.*

158. $150 \div 30 = 5 \times 2 = 10$ rods, *Ans.*

159. $150 \div 10 = 15 \times 2 = 30$ rods, *Ans.*

160. $10^2 - 5^2\ (10 \div 2) = 100 - 25 = 75$; $\sqrt{75} = 8‘66$ ft. perpendicular, and $8‘66 \div 2 = 4‘33 \times 10 = 43‘30$ ft. area, *A.*

161. $6 \times 6 = 36 \times 6 = 216$ feet, *Ans.*

162. $8 \times 4 = 32 \times 2 = 64$ cubic inches in one, which $\times 10 = 640$, *Ans. to the last.*

163. $1728 \div 64$ (number inches in one brick) $= 27$ brick in a cubic foot, which $\times 1000 = 27000$, *Ans. to the last.*

164. $40 \times 12 = 480 \times 2 = 960 \times 27 = 25920$, *Ans.*

166. $5000^3 = 125000000000 \div 200000000\ (1000 \times 10 \times 4 \times 5000) = 625$ hours, $=$ 26 days, 1 hour, *Ans.*

167. $380 \times 120 = 45600$; then, $45600 : 62700000 :: 1 : A. = 62700000 \div 45600 = 1375$ times, *Ans.*

168. $365 \times 24 = 8760$, which $\div 625$ (26 days, 1 hour,) $= 14\frac{2}{125}$, what the Po will discharge in 365 days, which $\times 1375 = 19272$ cubic miles, *Ans.*

169. $5 : 10\frac{1}{2} :: 62700000 : A. = 62700000 \times 10\frac{1}{2} = 658350000 \div 5 = 131670000$, number of square miles of

water, which × $\frac{1}{4}$ = 32917500, number of cubic miles in the ocean, which ÷ 19272, (number of cubic miles of water discharged, by all the rivers, into the sea in one year,) = 1708 years, 17 days, 12 hours, *Ans.*

170. 1000 × $13\frac{1}{2}$ = 13500 × $2\frac{1}{2}$ feet, (30 in. ÷ 12) = 33750 oz., which ÷ 16 = 2109‘375 lbs. on a square foot; then, 2109‘375 lbs. × 25000000 $(5000^2)$ = 52734375000 lbs. on a square mile; and 131670000 (No. of square miles of water,) + 62700000 (No. of square miles of land) = 194370000, whole No. of square miles on the surface of the globe, which × 52734375000 (No. of lbs. on one square mile) = 10249980468750000000 lbs. weight of the whole atmosphere, *Ans.*

171. 14 × $3\frac{1}{7}$ = 44 feet, *Ans.*

172. 4 × $3\frac{1}{7}$ = $12\frac{4}{7}$ feet, *Ans.*

173. 147 × $3\frac{1}{7}$ = 462 feet, *Ans.*

174. 462 ÷ $3\frac{1}{7}$ = 147 feet, *Ans.*

176. 11 (22 ÷ 2) × $3\frac{1}{2}$ (7 ÷ 2) = $38\frac{1}{2}$ square feet, *Ans.*

177. 176 ÷ $3\frac{1}{7}$ = 56, the diameter; then, 88 (176 ÷ 2) × 28 (56 ÷ 2) = 2464 rods, *Ans.*

178. 1‘57079 (3‘14159 ÷ 2) × $\frac{1}{2}$ (1 ÷ 2) = ‘7854 of a square rod, nearly, *A.*

180. $3\frac{1}{2}$ ÷ $3\frac{1}{7}$ = 11, the circumference; then, 11 × $3\frac{1}{2}$ = $38\frac{1}{2}$ square inches, *Ans.*

182. 7 × $3\frac{1}{7}$ = 22, circumference; then, 22 × 7 = 154 × $\frac{7}{6}$ ($\frac{1}{6}$ of 7) = $179\frac{2}{3}$ solid inches, *Ans.*

183. 24853 × 7911 = 196612083 × $1318\frac{1}{2}$ (7911 ÷ 6) = 259233031435 miles, *Ans.*

184. 3‘14159 × 20 = 6‘283180, the circumference; then, 6‘283180 × 20 = 125663600, area, which × $3\frac{1}{3}$ (20 ÷ 6) = 4188‘7823 cubic inches, and this ÷ 231 = 18‘132 gallons, *Ans.*

185. 3 × 10 = 30 solid feet, *Ans. to the last.*

186. 7 × $3\frac{1}{7}$ = 22, circumference; then, 11 (22 ÷ 2) × $3\frac{1}{2}$ (7 ÷ 2) = 38‘5 square inches, which, ÷ 144 = ‘26736 of a square foot, which × 20 = 5‘3472 cubic feet, *Ans.*

187. 3‘14159 × 18‘5 = 58‘1196, the cir.; then, 29‘0598 (58‘1196 ÷ 2) × 9‘25 (18‘5 ÷ 2) = 26880315, area of one end, which × 8 = 2150‘425 cubic inches, *Ans.*

189. 7 × $3\frac{1}{7}$ = 22 cir.; then, 11 (22 ÷ 2) × $3\frac{1}{2}$ (7 ÷ 2) = $38\frac{1}{2}$, the area of the base, which × 9 (27 ÷ 3) = $346\frac{1}{2}$ feet, *Ans.*

191. 36 in. — 27 in. = 9 in.; and 27 + 6 ($\frac{2}{3}$ of 9) = 33 in. mean diameter; then, $33^2$ = 1089 × 45 (length) = 49005 × 34 = 166‘6170, *Ans.*

194. 1 : 5 :: 4 : *A.* = 20 feet, *Ans.*

195. $\frac{1}{2}$ : 40 :: 175 : *A.* = 175 × 40 = 7000 ÷ $\frac{1}{2}$ = 14000 pounds, *Ans.*

196. 3 feet 4 inches = 40 inches, and 2 feet 6 inches = 30 inches; then, as they would carry parts inversely as the distance, 70 in. : 30 in :: 200 pounds : *A.* = 200 × 30 = 6000 ÷ 70 = $85\frac{5}{7}$ pounds; and 70 in. : 40 in. :: 200 pounds : *A.* = 200 × 40 = 8000 ÷ 70 = $114\frac{2}{7}$ pounds, *A.*

198. 10 : 1 :: 60 : *A.* = 60 ÷ 10 = 6 inches, *Ans.*

200. 10 × 2 = 20 × 12 = 240 inches, which × $3\frac{1}{7}$ = $754\frac{2}{7}$ ÷ $\frac{1}{4}$ = $3017\frac{1}{7}$ × 120 = $362057\frac{1}{7}$ pounds, *Ans.*

201. 1 in. : 120 in. :: 1 : *A.* = 120, *Ans.*

202. 231 ÷ 4 = $57\frac{3}{4}$; then, 231 — $57\frac{3}{4}$ = $173\frac{1}{4}$, *Ans.*

203. 14 — $2\frac{1}{2}$ = $11\frac{1}{2}$ qts., which ÷ 4 = $2\frac{7}{8}$ gallons; then, 231 × $2\frac{7}{8}$ = $664\frac{1}{8}$ inches, *Ans.*

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